SOIL SURVEY

Iowa County, Iowa

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
Iowa Agricultural Experiment Station

Issued May 1967

Major fieldwork for this soil survey was done in the period 1956–60. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1965. This survey was made cooperatively by the Soil Conservation Service and the Iowa State University Agricultural Experiment Station; it is part of the technical assistance furnished to the Iowa County Soil Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Iowa County contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in appraising the value of tracts of land for agriculture, industry, or recreation.

Locating Soils

All the soils of Iowa County are shown on the detailed map at the back of this report. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the report. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit or any other group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the section that describes the soils and from the section that discusses management of soils for cultivated crops and pasture.

Foresters and others can refer to the section "Management of Woodland," where the soils of the county are grouped according to their suitability for trees.

Engineers and builders will find under "Engineering Applications" tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

Scientists and others can learn something about the geology of the county, and about how the soils were formed and how they are classified, in the section "Genesis, Classification, and Morphology of the Soils."

Students, teachers, and others will find information about soils and their management in various parts of the text.

Cover picture: Typical landscape of Clinton and Lindley soils. Farm pond is about one-quarter of an acre in size; drainage area above pond is about 7 acres.

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NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued May 1967

EXPLANATION

Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas and Eldorado Valleys Area, Nev.
Series 1958, No. 34, Grand Traverse County, Mich.
Series 1959, No. 42, Judith Basin Area, Mont.
Series 1960, No. 31, Elbert County, Colo. (Eastern Part)
Series 1961, No. 42, Camden County, N.J.
Series 1962, No. 13, Chicot County, Ark.
Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

SOIL SURVEY OF IOWA COUNTY, IOWA

BY J. D. HIGHLAND AND R. I. DIDERIKSEN, SOIL CONSERVATION SERVICE

FIELDWORK BY J. D. HIGHLAND, W. D. FREDERICK, W. L. FOUTS, M. P. KOPPEN, A. R. HIDLEBAUGH, AND S. M. SMITH, SOIL CONSERVATION SERVICE, AND G. H. SIMONSON, IOWA AGRICULTURAL EXPERIMENT STATION

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE IOWA AGRICULTURAL EXPERIMENT STATION

IOWA COUNTY is in the east-central part of Iowa (fig. 1). It has a total area of 584 square miles, or 373,760 acres. Marengo, the county seat, is about 30 miles west of Iowa City.

The county is primarily agricultural. Although vegetables are grown on nearly every farm for home use, the principal crops are corn, oats, soybeans, and hay. Most of the grain that is grown is fed to livestock. Beef cattle and hogs are the principal source of income, but dairy farming is also important.

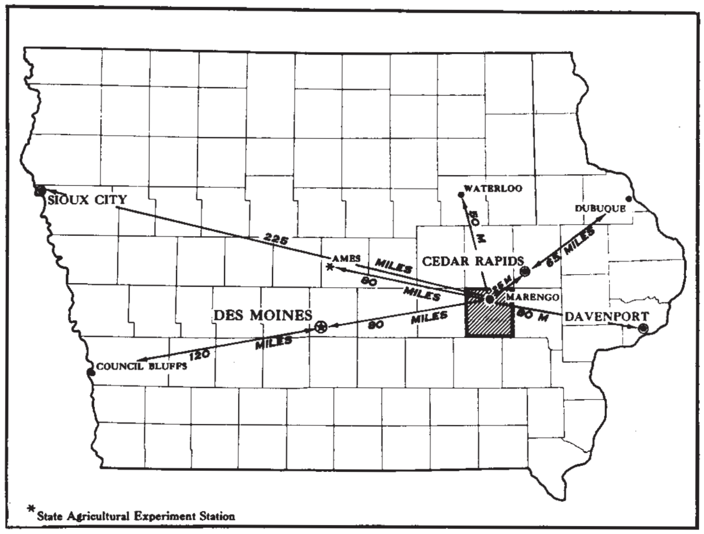

Figure 1.—**Location of Iowa County in Iowa.**

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Iowa County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Mahaska and Otley, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Waukegan loam and Waukegan silt loam are two soil types in the Waukegan series. The difference in texture of their surface layer is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Shelby loam, 5 to 9 percent slopes, is one of several phases of Shelby loam, a soil type that ranges from moderately sloping to steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees,

and other details that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Chelsea-Fayette-Lamont complex. Also, on most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Gullied land, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. On the basis of the yield and practice tables and other data, the soil scientists set up trial groups, and then test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this report shows, in color, the soil associations in Iowa County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of two or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

Described in the pages following and shown on the colored map at the back of this report are the nine soil associations in Iowa County.

1. Otley-Ladoga-Clinton association

Gently sloping or moderately sloping soils that formed from loess on uplands

This association is on gently sloping ridgetops and in moderately sloping valleys. It consists of divides between large watersheds and is the principle divide between the Iowa River and the North English River. The main stems of most drainageways in the county originate in these uplands. Most of the soils developed from loess, which is as much as 15 feet thick on the gently sloping ridges.

This association includes both dark-colored and light-colored soils that as a whole are moderately well drained. Drainage is adequate for most crops grown in the county. Drainageways generally are seepy and, if seeded, commonly need tile drains. Trees are scattered along some drainageways and along old fence rows, particularly in the southern part of the county between Old Mans Creek and the North English River and between the North English and Middle English Rivers.

The Otley, Ladoga, and Clinton soils are dominant in this association, but small areas of Colo, Judson, and Ely soils occur along drainageways. The Otley soils have a dark-colored surface layer and a yellowish-brown subsoil. The Colo and Ely soils have a thick, dark-colored surface layer and a grayish subsoil. The Judson soil has a thick, dark-colored surface layer and a brownish subsoil. Tile drains are needed in the Colo and Ely soils but generally are not required in the Judson soils.

Most of the acreage in this association is used for row crops. Only a small part is used for permanent pasture or is wooded. The slopes are gentle or moderate and generally are long and uniform. Thus, they are readily adaptable to both contouring and terracing. Drainageways commonly are in good condition. There are only a few gullies that cannot be crossed with farm machinery.

Farming is diversified. Corn, soybeans, and hay are the main crops. Most of the grain that is grown is fed to livestock. Hogs and cattle are the principle livestock, but there are a few dairy herds. Turkeys are important in the southern part of the county.

Farms vary in size, but generally are between 200 and 240 acres. The trend is toward larger farm units, and many farmers farm more than one unit. Most farmers use two-row and four-row crop equipment. If the farm is larger than average and the slope and shape of the field are uniform, some farmers use six-row and eight-row equipment. Most farm buildings are in good condition (fig. 2).

The soils of this association are for the most part moderately fertile but need nitrogen, phosphate, potash, and lime. Crops respond well to both fertilizer and lime. Yields generally are above average for the county.

Figure 2.—**Typical farmstead in the Otley-Ladoga-Clinton association. Otley soils are around the buildings in the background; Ely and Judson soils are at the base of the long, smooth slopes.**

2. Ladoga-Otley-Adair-Shelby association

Strongly sloping to steep, dark colored and moderately dark colored soils that formed from loess or glacial till on uplands

This association is on uplands that are dissected by many drainageways. Most of the drainageways are grassed and can be crossed with farm machinery. A few have cut deep gullies that, in places, separate one part of a farm from the other.

The Ladoga, Otley, Adair, and Shelby soils are dominant. The Ladoga and Otley soils formed in loess on the uplands. The Adair and Shelby soils developed in glacial material that is exposed on slopes bordering deeply cut drainageways (fig. 3). In most places there is a contour line along the valley slopes where the loess contacts the glacial till, but in some places this line is blurred by the sloughing of the loess.

The Ely, Judson, Colo, and Nodaway soils occur to a minor extent in the association. The Ely and Judson soils are in drainageways near the steeper soils of the uplands. The Colo and Nodaway soils are near the center of drainageways.

The soils of this association vary in color and in thickness of the surface layer. They commonly are medium or low in organic-matter content. Their available moisture capacity is adequate for most crops during years of normal rainfall. Drainage is good in most places, but there are some seepy spots about halfway up the slope where glacial material crops out. These spots are occupied by Adair soils, which in addition to being seepy are less fertile than the adjacent soils. The Adair soils commonly are left idle when the adjoining soils are cropped.

The hazard of erosion is slight to severe on the soils in this association, and contour tillage and terraces are needed to reduce soil loss. The Ladoga and Otley soils are well suited to terracing. The Adair and Shelby soils, but particularly the Adair, are less well suited. The Adair soils have a clayey, very slowly permeable subsoil and are low in fertility.

The county roads in this association generally follow section lines. The fields, on the whole, are smaller than those in associations 1 and 3, and pastures are more common than in association 1. Except for a few groves around farmsteads, most trees are scattered along drainageways and fence lines.

Most of this association is in general farms. Some of the steeper soils are used for meadow and permanent pasture, but the ridgetops, upper part of slopes, and wide drainageways are used mainly for row crops grown in rotation. Corn, oats, and hay are the principle crops. Much of the grain that is grown is fed to beef cattle and hogs, and additional grain may be purchased to fatten

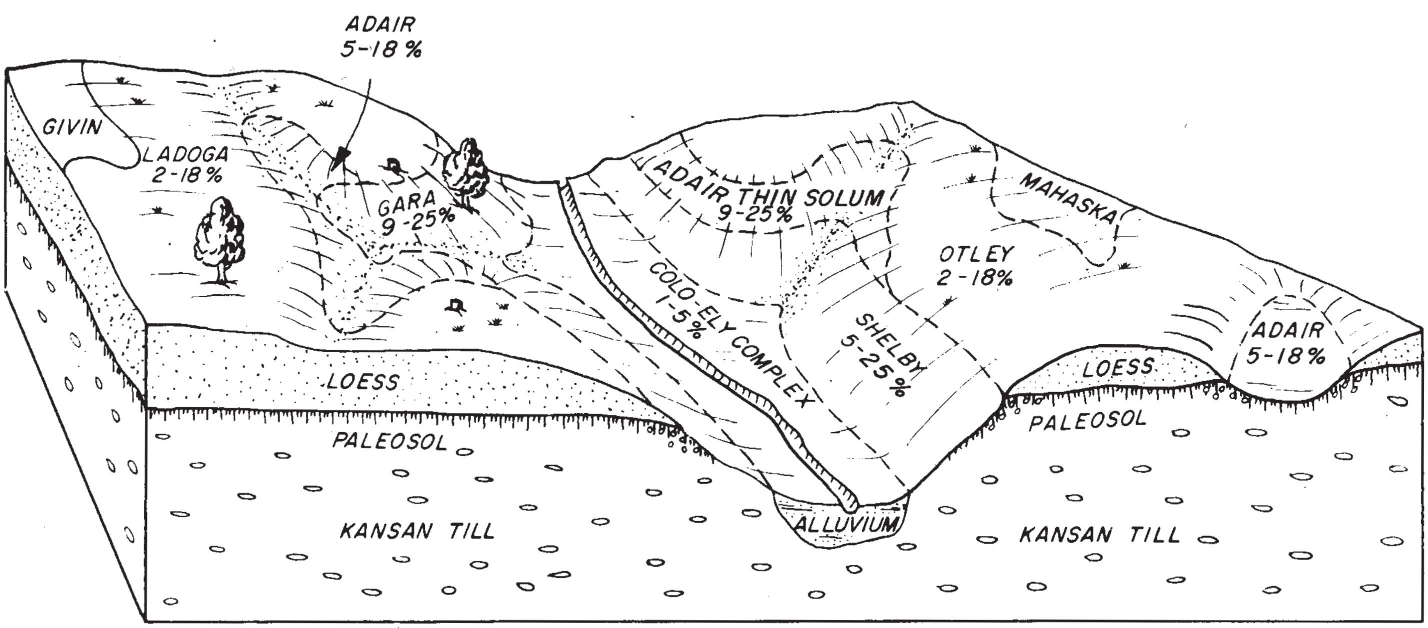

Figure 3.—**Diagram showing topography and parent material of important soils in soil associations 2 and 9 and the relationship of these soils to other soils in the county.**

livestock for market. Some cattle are raised, but many are brought in from outside the county.

Although most farm buildings are now occupied, buildings in the steeper areas are being abandoned as farms are enlarged. Farms ordinarily are larger than 200 acres, and the general trend is toward larger units. Many farmers farm more than one unit or parts of other units.

The soils in this association are moderate or low in fertility and need large amounts of nitrogen, phosphate, and potash. Lime generally is applied before the seeding of legumes. Crop yields generally are average for the county but vary widely from farm to farm.

3. Colo-Bremer-Nevin-Nodaway association

Nearly level or undulating soils on bottom lands

This association is on nearly level bottom lands along the Iowa and English Rivers and their tributaries. The soils range from well drained to very poorly drained. Most of the soils formed from sediments that were deposited on the flood plains of large streams (fig. 4) ; a few formed on high benches where the parent material is loess.

The Colo, Bremer, Nevin, and Nodaway soils are dominant in this association, but the Zook, Wabash, and Wiota soils and Alluvial land are also important. Flooding is the principal hazard on most of these soils. Tile or surface drainage is needed in many areas, but good outlets generally are difficult to establish.

The Colo and Bremer soils are the most important of the poorly drained soils. In many places these soils have been improved by the installation of tile lines. The Zook and Wabash soils are very slowly permeable and are poorly drained. Tile lines have been installed in some areas of the Zook soils and function satisfactorily, but surface drains are needed to remove excess water from the Wabash soils. Spring plowing is often delayed on these soils because of wetness. Consequently, many areas are plowed in fall when the moisture content is more favorable.

The Nodaway soils are moderately well drained or somewhat poorly drained. They commonly occur nearer to stream channels than the Colo, Wabash, and Zook soils and thus are frequently overflowed. The Nevin and Wiota soils are at slightly higher elevations than the other soils in this association and generally are above flood stage.

Alluvial land, which occurs on bottom lands bordering the Iowa River, is frequently flooded. In addition, water often remains ponded in the oxbows and remnants of former stream channels that dissect this land. In many places the bottom lands are gently undulating because of the depressions, or channels, of former meanders and the natural levees that formed along the edges of these depressions during periods of flooding. Alluvial land is used principally for pasture and woods, and much of the acreage is covered with low-grade trees. Crops are grown only occasionally in a few small areas between the oxbows.

Except for Alluvial land, the soils in this association are well suited to cultivated crops and are used intensively for corn and soybeans. Yields of cultivated crops generally are above county averages. The acreage of legume hay is much less than in the other associations in the county.

Although the county roads and farms in this association commonly form rectangular patterns, the shape of fields is determined to some extent by the boundaries of streams, oxbows, and old stream meanders. Many roads parallel the rivers, but the network of roads is sketchy, and only a few roads cross the rivers. Some farm buildings have been abandoned, and farms now tend to be larger than average for the county. The farmsteads, which occur mainly along the margins of bottom lands, generally are well kept and commonly have facilities for feeding beef cattle and hogs. Some of the grain that is grown in this association is sold to farmers in other parts of the county or to local grain dealers. Soybeans are the most important cash crop.

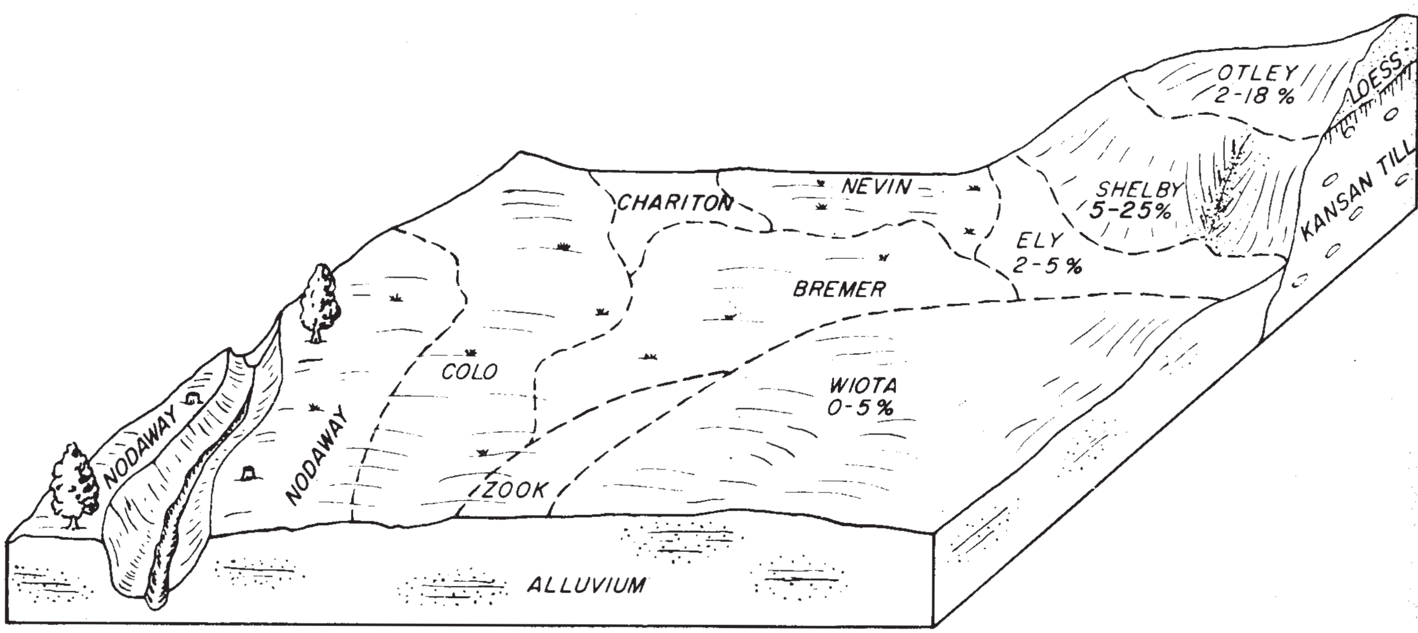

***Figure 4.*—Diagram showing topography and parent material of important soils of association 3, and their relationship to other soils in the county.**

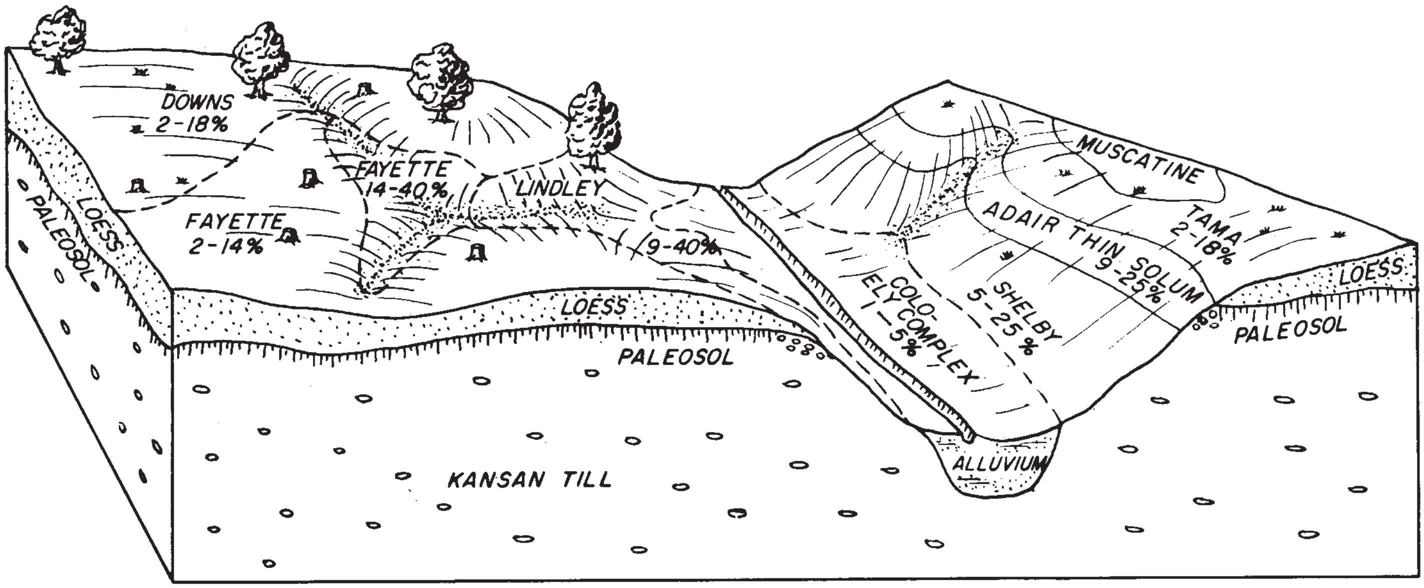

Figure 5.—**Diagram showing topography and parent material of important soils in soil associations 4 and 7, and the relationship of these soils to other soils in the county.**

The soils in this association are used intensively for row crops. Consequently, large amounts of fertilizer are used. Land values range from high to low and are much more variable than in the other soil associations.

4. Tama-Downs-Shelby association

Nearly level to steep, dark colored and moderately dark colored soils that formed from loess and glacial till on uplands

This association is confined entirely to the northern part of the county, adjacent to the Iowa River and Bear Creek. The nearly level soils occur mainly in narrow stream valleys and to a lesser extent on upland divides. The steep soils are adjacent to the flood plains of large streams. Although the soils are for the most part well drained, there are some seepy areas on side slopes. These seepy areas are almost on a contour line along the valley slopes. Small streams have dissected the uplands, but most of the waterways are grassed and can be crossed with farm machinery. In some places, however, the streams have cut deep gullies that separate one part of a farm from the other.

The Tama, Downs, and Shelby soils are dominant in this association (fig. 5). The Gara, Adair, Colo, Ely, Judson, Muscatine, and Atterberry are the minor soils. The soils of this association generally are similar to the soils of association 2, except that the loess-derived Tama and Downs soils are better drained than the loess-derived Ladoga and Otley soils.

The Tama and Downs soils are on ridgetops and on the upper part of side slopes. The Shelby, Gara, and Adair soils formed from glacial till and are on the lower part of slopes that border deeply cut drainageways (fig. 6). The Colo, Ely, and Judson soils occur in most waterways, and the Muscatine and Atterberry soils are on divides.

The hazard of erosion in this association ranges from slight to severe because of the wide range in slope. Tilling on the contour, stripcropping on the contour, and terracing are needed to reduce soil losses. The Tama and Downs soils are well suited to terracing because they typically have long uniform slopes and a comparatively fertile permeable subsoil. The Shelby and Gara soils are less well suited because their slopes commonly are steep and irregular, and their subsoil is low in fertility. Tile drains are needed on the sides of most waterways to control seepage.

The soils of this association are used primarily for corn, oats, hay, and pasture. The steeper soils are used mainly for meadow and permanent pasture. Row crops are grown in rotation on ridgetops, on the upper part of slopes, and along drainageways. The moisture-holding capacity of the soils is adequate for most crops during years of normal rainfall.

The raising of hogs and beef cattle is the dominant enterprise in this association. Dairying is also important on

Figure 6.—**Typical landscape in soil association 4. The light-colored band in the background is a severely eroded Adair soil. The dark-colored soils in the drainageway are the Colo-Ely complex, 1 to 5 percent slopes.**

some farms. Most of the grain that is grown is fed to livestock.

The fields in this association commonly form a rectangular pattern. However, contour fields are becoming increasingly noticeable. County roads ordinarily follow section lines but deviate in places because of the topography. Except for some groves of trees around farmsteads, most trees are scattered along waterways and fence rows.

Most of the farm buildings are well kept and are occupied. Farms, as a rule, are between 200 and 240 acres in size, but many farmers farm more than one unit or farm parts of other units.

The soils in this association range from high to low in fertility. On most farms, yields are average or above average. Large amounts of nitrogen, phosphate, and potash are used, and lime commonly is applied before legumes are seeded.

5. Chelsea-Fayette-Hagener-Tama association

Undulating to hilly sandy and silty soils

This association is characterized by undulating to very steep slopes in a series of rolling, dome-shaped hills. It consists of soils that formed from sandy and silty material deposited mainly by wind. These soils occur in complex patterns, generally in small areas adjacent to major streams throughout the county. One large continuous area occurs on the south side of the Iowa River and extends from the center of the county eastward to the county line. Many waterways dissect this association. Some are sloped and grassed, but others have cut deep gullies that, in places, separate one part of a farm from the other.

The dominant soils in this association are the sandy Chelsea and Hagener soils and the silty Fayette and Tama soils. The Lamont and Dickinson soils are the minor soils.

The Chelsea and Fayette soils are light colored and are low in organic-matter content. The Lamont soils have properties intermediate between those of the Chelsea and Fayette. In many places these three soils occur in such intricate patterns that it was not practical to map them separately. The Tama soils are the dominant dark-colored silty soils, and the Hagener are the dominant dark-colored sandy soils. These soils are also so closely associated that in many places they were not separated in mapping. The Dickinson soils have many properties intermediate between those of the Tama and Hagener soils.

The soils in this association range from well drained to excessively drained. The Chelsea and Hagener soils have low moisture-holding capacity; the Tama and Fayette soils have high moisture-holding capacity; and the Lamont and Dickinson soils have low or moderate moisture-holding capacity.

The hazard of erosion ranges from slight to severe. Because of the length and irregularity of the slopes, conservation practices need to be carefully designed and applied. Wind erosion has caused small blowouts in some areas of the Chelsea and Hagener soils.

This association is not extensive, and only a few farms are entirely within the association. Field boundaries generally are irregular and commonly follow ridges or waterways. Most of the acreage is in permanent pasture

Figure 7.—**Unimproved bluegrass pasture and woodland in soil association 5.**

and woods (fig. 7). The largest continuous wooded areas in the county are in this association, in the vicinity of Homestead. Corn, oats, and hay are grown on the less sloping soils and occasionally in rotation on the steeper soils. Yields of crops vary greatly but generally are below average for the county.

6. Clinton-Lindley-Gara-Keswick association

Strongly sloping to steep, light-colored and moderately dark colored soils that formed from loess and glacial till on uplands

This association is on the strongly dissected hilly uplands that border the level flood plains of the English River and Old Mans Creek, in the southern half of the county. Narrow rounded ridgetops, long steep side slopes, and steep narrow valleys are the principal topographic features. Patches of forest and scattered trees remain from the original forest cover.

The Clinton, Lindley, Gara, and Keswick soils are the dominant soils in this association. The Clinton soils developed in loess, mainly on the rounded ridgetops and on the upper part of side slopes (fig. 8). The Lindley, Gara, and Keswick soils formed in glacial till that outcrops on the lower part of steep slopes. The contact between the loess and the till commonly forms a contour line along the valley slopes. The Keswick soils, which occur as narrow bands in these areas, are low in fertility and are often seepy in spring. They commonly are left idle when adjoining soils are cropped.

The Nodaway soils are minor soils in the association. They occur along the numerous drainageways that dissect the uplands. Deep active gullies have formed along many of these drainageways (fig. 9). Some of these gullies have been stabilized by the construction of ponds for watering livestock.

Runoff is high on the soils of this association because of the steep slopes. Consequently, in cultivated fields, the hazard of erosion is moderate or severe. Most areas are

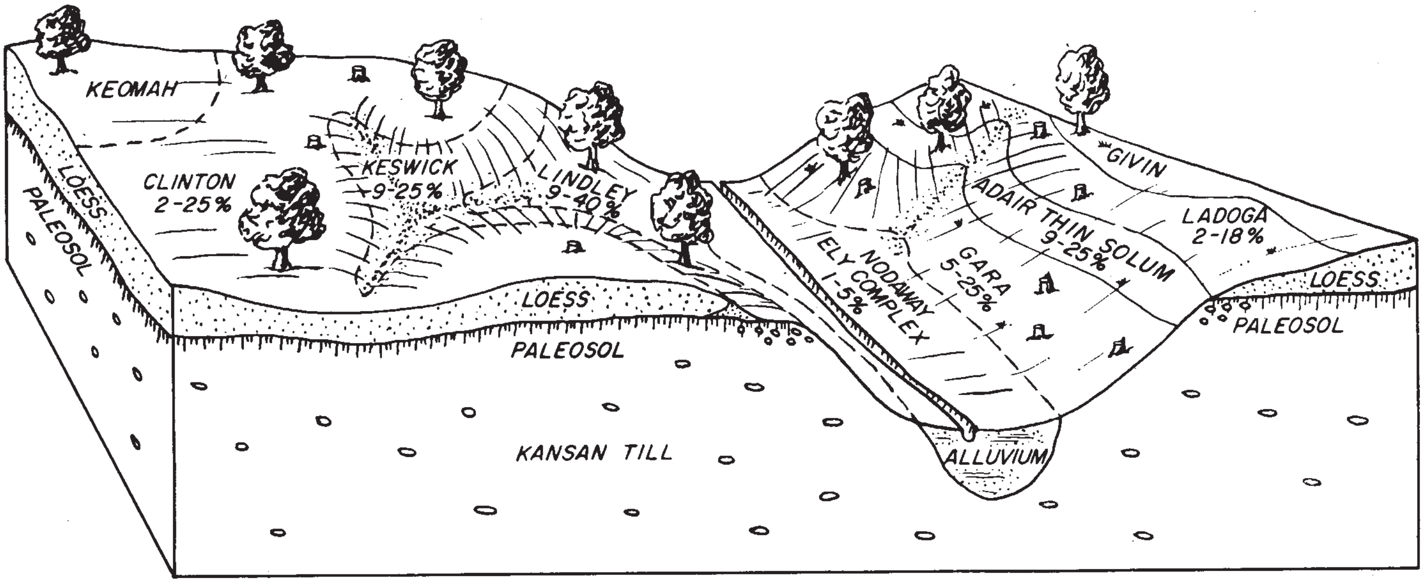

Figure 8.—**Diagram showing topography and parent material of soils in soil association 6, and the relationship of these soils to other soils in the county.**

too steep for terracing. Thus, the dominant erosion control practices are tilling on the contour, stripcropping on the contour, and the use of a rotation in which meadow crops are grown much of the time. A large part of this association is in meadow, permanent pasture, and woods (fig. 10), but row crops are grown in rotation on ridgetops, on the upper part of slopes, and in narrow valleys.

The raising of beef cattle is the main agricultural enterprise, and many good herds of beef cows are pastured on these soils. Ponds are numerous, and most farms have one or more ponds for watering livestock.

Although the farms tend to be larger than average in size, the farmsteads generally are smaller than those in the other associations, and abandoned farmsteads are more common. Many farmers live in areas where row crops can be grown more frequently and use this land for pasture. Most county roads follow section lines; a few follow the valleys and ridgetops.

Generally, the soils are lower in fertility and the response to fertilizer is less than in adjoining associations. Lime commonly is needed before legumes are seeded. Yields of crops vary but ordinarily are below average for the county.

7. Fayette-Downs association

Gently sloping to steep, light-colored and moderately dark colored soils that formed from loess on uplands

This association is on narrow sloping ridgetops and gently sloping to very steep side slopes, mainly adjacent to the Iowa River. The largest areas are on the north side of the river. The soils next to the river valley are mostly

Figure 9.—**Gullies have formed in a bluegrass pasture on the Nodaway soils, in soil association 6. The Clinton and Lindley soils are on the uplands.**

Figure 10.—**In background, typical unimproved pasture on the Clinton and Lindley soils, in soil association 6. In foreground, Clinton silt loam.**

rolling and hilly (see fig. 5). Narrow, steep-sided valleys that drain to the Iowa River and its tributaries are also characteristic of this association. Trees are scattered along roads, fence lines, and drainageways, and small groves are around farmsteads. In places patches of oak-hickory type forest remain from the native vegetation. These patches of forest and the wide distribution of trees are distinctive features of the landscape.

The Fayette and Downs soils are dominant in this association. The Downs soils are darker colored than the Fayette and generally are on the more gentle slopes. The Fayette soils are on rounded fingerlike ridges and on steep U-shaped side slopes. The Lindley and Nodaway soils are of minor extent. In places the Lindley soils are near the base of steep slopes; the Nodaway soils are along the many waterways that dissect this association. Deep, active, tree-lined gullies are numerous and in many places separate one part of a farm from the other. Consequently, fields commonly are odd shaped and irregular.

Because of the steepness of the slope, runoff is rapid and erosion is a moderate or severe hazard if the soils are cultivated. Many areas are too steep for terraces. Thus, the principal erosion control practices are tilling on the contour, stripcropping on the contour, and the use of a meadow crop in the rotation. Tile drains are needed in some waterways.

A large part of this association is in meadow, permanent pasture, or woods. The ridgetops and some of the less strongly sloping side slopes are used for row crops grown in rotation.

Farming in this association is diversified. Crops and livestock are the main products, and most of the grain that is grown is fed to hogs or to beef and dairy cattle. Farms vary in size but generally are larger than 200 acres, and the general trend is toward larger units. A few farmsteads are in the small valleys, but most are on ridgetops or at the edge of the large flood plains that border the Iowa River. The buildings for the most part are in good repair and are occupied. Many farmers that live on the border between this association and soil association 3 use this land for hay and pasture, and use the more nearly level soils of soil association 3 for row crops. County roads seldom follow section lines; most roads are along the divides or at the edge of the valleys.

Yields vary widely from farm to farm but generally are average or above average if management is good. Fertility commonly is moderate, and the response to lime and fertilizer is good. Lime ordinarily is needed if legumes are grown.

Although there are many ponds for watering livestock in this association, the soils as a whole are not so well suited to ponds as the soils of associations 2 and 6, because they are lower in content of clay and generally have a more permeable subsoil and substratum. Therefore, careful design and construction are important if these soils are used for this purpose.

8. Bassett-Dinsdale-Kenyon association

Gently sloping or sloping, dark colored and moderately dark colored soils that developed from loess over loam till and till on uplands

This is one of the smallest associations in the county. It occurs almost entirely in the northeastern corner and consists largely of undulating areas, with distinct stream channels and almost no depressions where shallow ponds can form. The drainageways are concave and are less entrenched than those in all the other associations, except 7 and 9. The low, smooth, rounded slopes give this association a distinctly different topography from the rest of the county. The borders are hilly and are strongly dissected. This association includes what geologists call the Iowan till plain. The glacial till in this part of the county is dominantly loam, whereas in other parts it is typically clay loam. A pebble band, or stone line, commonly occurs at a depth of 2 or 3 feet and generally can be seen in road cuts.

Most of the soils in this association developed from glacial till or from loess over glacial till. The loess, or silty material, occurs on most of the more gently sloping convex ridges and ranges from 20 to 40 inches in thickness over the till. The till crops out on side slopes. The soils on both ridges and side slopes are mostly well drained or moderately well drained and are only slightly or moderately susceptible to erosion. They are well suited to terracing.

The Bassett, Kenyon, and Dinsdale soils are the major soils in this association. The Bassett and Kenyon soils formed from glacial till. The Bassett soils have a moderately thick, moderately dark colored surface layer and a loamy, brownish subsoil that contains some stones and pebbles. The Kenyon soils are similar to the Bassett but generally have a darker colored, thicker surface layer. The Dinsdale soils formed in 20 to 40 inches of loess over loam till. They have a dark-colored surface layer and a brownish subsoil that is free of stones and pebbles in the upper part but contains some stones and pebbles in the lower part.

The minor soils in this association are those of the Waubeek, Colo, Ely, Hagener, Dickinson, Tama, and Muscatine series. The Waubeek soils are similar to the Dinsdale but typically are lighter colored and lower in organic-matter content. The Colo soils, which are dark colored, are poorly drained, and the Ely soils are somewhat poorly drained. These soils occur in drainageways that, in places, are gullied to the extent that they separate one part of a farm from the other. The Hagener and Dickinson soils are sandy and occur mostly in small areas. The Tama and Muscatine soils occur only where the loess is thicker than 40 inches. In the vicinity of Homestead, they are underlain by a sandy zone that ranges from a few inches to several inches in thickness above the glacial till.

Much of the acreage in this association is cultivated. Permanent pastures are confined mainly to poorly drained swales and waterways. Trees cover much of the area in the vicinity of Homestead, but in other places they occur mainly in groves or as windbreaks around farm buildings. County roads generally follow section lines, and fields and roads commonly form rectangular patterns.

Farming in this association is diversified. Most of the grain that is grown is fed to hogs or to beef and dairy cattle. Some soybeans are grown for a cash crop. Nearly all farm buildings are occupied and in good repair. Farms vary in size but generally are between 200 and 240 acres. The general trend is toward larger units. The soils for the most part are moderately fertile, and the response to fertilizer is good. Lime commonly is needed before legumes are seeded.

9. Mahaska-Taintor-Givin association

Nearly level, somewhat poorly and poorly drained soils that formed from loess on uplands

This association is in the southern two-thirds of the county. It forms the major divides between the English and Iowa Rivers and between Old Mans Creek and the Iowa and English Rivers. These divides are remnants of a former level plain but are now the highest part of the landscape (see fig. 3). They are from 1 to 5 miles apart and are separated by undulating to sloping areas. They are irregular in shape but generally consist of a long, winding stem and many smaller branches. They range from as little as 1 mile in length to as much as 10 miles. The main divides are generally less than 1 mile in width, and the branches are from ¼ to ½ mile in width. The towns of Conroy and Parnell are in this association.

The soils in this association developed from loess, which is from 16 to 18 feet thick. All of the soils developed under grass, except the Givin soils, which developed under both grass and trees. The soils are dominantly somewhat poorly drained or poorly drained. Tile lines are used to drain most areas, and in some places surface drains are used to remove ponded water.

The Mahaska, Taintor, and Givin soils are the major soils in this association. The Mahaska soils have a thick, black to very dark gray surface layer and a dark grayish-brown subsoil that is free of pebbles and stones. The Taintor soils are similar to the Mahaska, but they are more poorly drained and have a very dark gray to dark gray subsoil. The Givin soils have a thinner, lighter colored surface layer than the Mahaska soils and a grayish-brown subsoil. The Sperry soils, which are minor soils, occur in slightly depressed areas and are often ponded early in spring. These areas generally are between 1 and 2 acres in size.

Most of this association is used for row crops. Only the small lots associated with farmsteads are used for permanent pasture. Corn and soybeans are grown almost continuously; meadow crops are grown occasionally. Only a few farms are located entirely within this association. Thus, the crop rotation depends somewhat on the rotation used on adjoining soils. Fields are rectangular, and rows of corn and soybeans are long and straight. Nearly all farm buildings are occupied and in good repair. Most of the corn that is grown is fed to hogs or to beef cattle. Soybeans are grown for a cash crop.

The soils of this association are among the most productive soils in the county, and yields generally are well above the county average.

Descriptions of the Soils

This section describes the soil series and the mapping units in Iowa County. The procedure is first to describe each soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs.

The soil series contains a description of the soil profile, the major layers from the surface downward. This profile is considered typical, or representative, for all the soils of the series. If the profile for a given mapping unit differs from this typical profile, the differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. Some technical terms are used in describing soil series and mapping units, simply because there are no nontechnical terms that convey precisely the same meaning. Many of the more commonly used terms are defined in the Glossary.

The acreage and proportionate extent of the mapping units are shown in table 1. Detailed technical descriptions of soil series are given in the section "Genesis, Classification, and Morphology of the Soils." At the back of the report is a list of the mapping units in the county and the capability unit each is in. The page where each of these groups is described is also given.

Adair Series

The Adair series consists of dark-colored, moderately well drained, very slowly permeable soils of the uplands. These soils developed in weathered, fine-textured, reddish glacial till and at one time were buried soils. They generally occur in bands on hillsides between the higher lying Otley soils and the lower lying Shelby soils. The slope ranges from 5 to 25 percent but is mostly between 9 to 18 percent.

Representative profile:

0 to 12 inches, very dark gray to very dark grayish-brown clay loam or loam; friable.

12 to 26 inches, reddish-brown to dark-brown, gritty clay; few red, dark-red, and strong-brown mottles; very firm.

26 to 60 inches, yellowish-brown clay loam; some pebbles; some strong-brown, yellowish-brown, and gray mottles; firm.

In spring, the Adair soils generally are wet and seepy. Interceptor tile placed above the seepage line helps to improve the more seepy areas. These soils erode readily because they are steep and have a fine-textured, slowly permeable subsoil. They are low in available nitrogen, phosphorus, and potassium and in most places are medium acid. Seedbeds are difficult to prepare, and yields are poor. The response to commercial fertilizer is fair.

Adair clay loam, 5 to 9 percent slopes, moderately eroded (AaC2).—The surface layer of this soil is very dark grayish-brown clay loam and is 3 to 6 inches thick. The subsoil of reddish gritty clay is thick and distinct. Some severely eroded spots in which the surface layer is reddish-brown clay are included in the areas mapped.

Interceptor tile is needed in places to drain spots that become seepy in spring. This soil is suited to only a limited amount of cultivation but is often farmed with adjoining soils. It needs to be farmed on the contour if row crops are grown. Yields, however, will be low even if management is good. *Capability unit IIIe-5.*

Adair clay loam, 9 to 14 percent slopes, moderately eroded (AaD2).—The surface layer of this soil is very dark grayish-brown clay loam and is from 3 to 6 inches thick. The subsoil of reddish gritty clay is thick and distinct. Included in the areas mapped are a few small areas in which the surface layer is very dark brown to very dark gray and is about 8 inches thick.

This soil is better suited to hay or pasture than to tilled crops, but where it occurs as narrow bands on side slopes, it is often farmed with adjoining soils. These areas can be left in meadow an extra year when adjacent soils are cultivated. Hay can be harvested from these areas. If

TABLE 1.—*Approximate acreage and proportionate extent of soils*

Soil	Acres	Percent
Adair clay loam, 5 to 9 percent slopes, moderately eroded	278	0. 1
Adair clay loam, 9 to 14 percent slopes, moderately eroded	2, 322	. 6
Adair clay loam, 14 to 18 percent slopes, moderately eroded	532	. 1
Adair clay loam, thin solum, 9 to 14 percent slopes, moderately eroded	2, 806	. 8
Adair clay loam, thin solum, 14 to 18 percent slopes, moderately eroded	1, 513	. 4
Adair soils, 9 to 14 percent slopes, severely eroded	1, 735	. 5
Adair soils, 14 to 18 percent slopes, severely eroded	627	. 2
Adair soils, thin solum, 9 to 14 percent slopes, severely eroded	1, 564	. 4
Adair soils, thin solum, 14 to 18 percent slopes, severely eroded	2, 431	. 7
Adair soils, thin solum, 18 to 25 percent slopes, severely eroded	453	. 1
Alluvial land	11, 241	3. 0
Amana silt loam	3, 456	. 9
Amana-Lawson-Nodaway complex	2, 663	. 7
Atterberry silt loam	665	. 2
Atterberry silt loam, benches	299	. 1
Bassett loam, 5 to 9 percent slopes, moderately eroded	932	. 2
Bassett loam, 9 to 14 percent slopes, moderately eroded	366	. 1
Bassett loam, 14 to 18 percent slopes, moderately eroded	108	(1)
Bassett loam, 18 to 25 percent slopes, moderately eroded	70	(1)
Bassett soils, 9 to 14 percent slopes, severely eroded	262	. 1
Bassett soils, 14 to 18 percent slopes, severely eroded	159	(1)
Bertrand silt loam, 0 to 2 percent slopes	151	(1)
Bertrand silt loam, 2 to 5 percent slopes	452	. 1
Bertrand silt loam, 5 to 9 percent slopes, moderately eroded	140	(1)
Bremer silty clay loam	5, 874	1. 6
Bremer silt loam, overwash	397	. 1
Chariton silt loam	620	. 2
Chelsea fine sand, 2 to 9 percent slopes	221	. 1
Chelsea fine sand, 9 to 18 percent slopes	464	. 1
Chelsea fine sand, 18 to 40 percent slopes	187	. 1
Chelsea-Fayette-Lamont complex, 5 to 9 percent slopes	891	. 2
Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes	606	. 2
Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes, moderately eroded	1, 296	. 3
Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes	322	. 1
Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes, moderately eroded	1, 335	. 4
Chelsea-Fayette-Lamont complex, 18 to 40 percent slopes	1, 935	. 5
Clinton silt loam, 2 to 5 percent slopes	2, 689	. 7
Clinton silt loam, 5 to 9 percent slopes	429	. 1
Clinton silt loam, 5 to 9 percent slopes, moderately eroded	8, 959	2. 4
Clinton silt loam, 9 to 14 percent slopes	680	. 2
Clinton silt loam, 9 to 14 percent slopes, moderately eroded	11, 008	2. 9
Clinton silt loam, 14 to 18 percent slopes, moderately eroded	3, 231	. 9
Clinton silt loam, 18 to 25 percent slopes, moderately eroded	694	. 2
Clinton soils, 9 to 14 percent slopes, severely eroded	3, 340	. 9
Clinton soils, 14 to 18 percent slopes, severely eroded	2, 025	0. 5
Colo silty clay loam	5, 038	1. 3
Colo silt loam, overwash	9, 137	2. 5
Colo-Ely complex, 1 to 5 percent slopes	25, 143	6. 7
Coppock silt loam	159	(1)
Dickinson sandy loam, 0 to 2 percent slopes	257	. 1
Dickinson sandy loam, 2 to 5 percent slopes	318	. 1
Dickinson sandy loam, 5 to 9 percent slopes	190	. 1
Dinsdale silty clay loam, 2 to 5 percent slopes	936	. 3
Dinsdale silty clay loam, 5 to 9 percent slopes	653	. 2
Downs silt loam, 2 to 5 percent slopes	2, 168	. 6
Downs silt loam, 5 to 9 percent slopes	919	. 2
Downs silt loam, 5 to 9 percent slopes, moderately eroded	5, 385	1. 4
Downs silt loam, 9 to 14 percent slopes, moderately eroded	5, 582	1. 5
Downs silt loam, 14 to 18 percent slopes, moderately eroded	1, 280	. 3
Downs silt loam, benches, 2 to 5 percent slopes	331	. 1
Downs soils, 9 to 14 percent slopes, severely eroded	466	. 1
Downs soils, 14 to 18 percent slopes, severely eroded	649	. 2
Ely silt loam, 2 to 5 percent slopes	5, 797	1. 6
Fayette silt loam, 2 to 5 percent slopes	1, 971	. 5
Fayette silt loam, 5 to 9 percent slopes	1, 754	. 5
Fayette silt loam, 5 to 9 percent slopes, moderately eroded	4, 726	1. 3
Fayette silt loam, 9 to 14 percent slopes	1, 591	. 4
Fayette silt loam, 9 to 14 percent slopes, moderately eroded	4, 384	1. 2
Fayette silt loam, 14 to 18 percent slopes	716	. 2
Fayette silt loam, 14 to 18 percent slopes, moderately eroded	2, 123	. 6
Fayette silt loam, 18 to 25 percent slopes	1, 525	. 4
Fayette silt loam, 18 to 25 percent slopes, moderately eroded	2, 663	. 7
Fayette silt loam, 25 to 40 percent slopes	4, 142	1. 1
Fayette silt loam, benches, 2 to 5 percent slopes	222	. 1
Fayette soils, 9 to 14 percent slopes, severely eroded	1, 668	. 4
Fayette soils, 14 to 18 percent slopes, severely eroded	2, 533	. 7
Fayette soils, 18 to 25 percent slopes, severely eroded	1, 758	. 5
Gara loam, 5 to 9 percent slopes, moderately eroded	120	(1)
Gara loam, 9 to 14 percent slopes, moderately eroded	1, 120	. 3
Gara loam, 14 to 18 percent slopes, moderately eroded	2, 072	. 6
Gara loam, 18 to 25 percent slopes, moderately eroded	867	. 2
Gara soils, 9 to 14 percent slopes, severely eroded	349	. 1
Gara soils, 14 to 18 percent slopes, severely eroded	2, 011	. 5
Gara soils, 18 to 25 percent slopes, severely eroded	1, 087	. 3
Givin silt loam	1, 206	. 3
Gullied land	363	. 1
Hagener fine sand, 0 to 2 percent slopes	155	(1)
Hagener fine sand, 2 to 5 percent slopes	438	. 1
Hagener fine sand, 5 to 9 percent slopes	826	. 2
Hagener fine sand, 9 to 14 percent slopes	526	. 1
Hagener fine sand, 14 to 25 percent slopes	194	. 1
Hagener-Tama complex, 2 to 5 percent slopes	198	. 1
Hagener-Tama complex, 5 to 9 percent slopes	382	. 1
Hagener-Tama complex, 5 to 9 percent slopes, moderately eroded	475	. 1

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of soils*—Continued

Soil	Acres	Percent
Hagener-Tama complex, 9 to 14 percent slopes, moderately eroded	1, 158	0. 3
Hagener-Tama complex, 14 to 18 percent slopes, moderately eroded	521	. 1
Hopper silt loam, 9 to 14 percent slopes, moderately eroded	227	. 1
Hopper silt loam, 14 to 18 percent slopes, moderately eroded	180	(1)
Hopper silt loam, 14 to 18 percent slopes, severely eroded	135	(1)
Hopper silt loam, 18 to 25 percent slopes, moderately eroded	261	. 1
Jackson silt loam	902	. 2
Judson silt loam, 2 to 6 percent slopes	3, 626	1. 0
Kenyon loam, 2 to 5 percent slopes	285	. 1
Kenyon loam, 5 to 9 percent slopes	597	. 2
Kenyon loam, 5 to 9 percent slopes, moderately eroded	637	. 2
Kenyon loam, 9 to 14 percent slopes, moderately eroded	65	(1)
Keomah silt loam	150	(1)
Keswick loam, 9 to 14 percent slopes, moderately eroded	1, 331	. 4
Keswick loam, 14 to 18 percent slopes, moderately eroded	1, 734	. 5
Keswick loam, 18 to 25 percent slopes, moderately eroded	193	. 1
Keswick soils, 9 to 14 percent slopes, severely eroded	1, 032	. 3
Keswick soils, 14 to 18 percent slopes, severely eroded	2, 292	. 6
Keswick soils, 18 to 25 percent slopes, severely eroded	420	. 1
Koszta silt loam	2, 841	. 8
Ladoga silt loam, 2 to 5 percent slopes	6, 298	1. 7
Ladoga silt loam, 5 to 9 percent slopes	2, 291	3. 5
Ladoga silt loam, 5 to 9 percent slopes, moderately eroded	13, 093	3. 5
Ladoga silt loam, 9 to 14 percent slopes	824	. 2
Ladoga silt loam, 9 to 14 percent slopes, moderately eroded	10, 242	2. 7
Ladoga silt loam, 14 to 18 percent slopes, moderately eroded	977	. 3
Ladoga silt loam, benches, 2 to 5 percent slopes	268	. 1
Ladoga soils, 9 to 14 percent slopes, severely eroded	1, 364	. 4
Ladoga soils, 14 to 18 percent slopes, severely eroded	440	. 1
Lawler loam	82	(1)
Lawson silt loam	625	. 2
Lindley loam, 9 to 14 percent slopes, moderately eroded	424	. 1
Lindley loam, 14 to 18 percent slopes, moderately eroded	1, 915	. 5
Lindley loam, 18 to 25 percent slopes	772	. 2
Lindley loam, 18 to 25 percent slopes, moderately eroded	3, 540	. 9
Lindley loam, 25 to 40 percent slopes	2, 259	. 6
Lindley soils, 9 to 14 percent slopes, severely eroded	241	. 1
Lindley soils, 14 to 18 percent slopes, severely eroded	1, 267	. 3
Lindley soils, 18 to 25 percent slopes, severely eroded	3, 251	. 9
Mahaska silty clay loam	7, 363	2. 0
Muscatine silty clay loam	1, 231	. 3
Nevin silty clay loam	5, 849	1. 6
Nodaway silt loam	5, 940	1. 6
Nodaway silt loam, channeled	1, 142	. 3
Nodaway silt loam, silty clay loam substratum	638	. 2
Nodaway-Ely complex	11, 283	3. 0
Otley silty clay loam, 2 to 5 percent slopes	15, 715	4. 2
Otley silty clay loam, 5 to 9 percent slopes	2, 401	. 6
Otley silty clay loam, 5 to 9 percent slopes, moderately eroded	17, 321	4. 6
Otley silty clay loam, 9 to 14 percent slopes, moderately eroded	10, 889	2. 9
Otley silty clay loam, 9 to 14 percent slopes, severely eroded	604	. 2
Otley silty clay loam, 14 to 18 percent slopes, moderately eroded	282	. 1
Otley silty clay loam, benches, 2 to 5 percent slopes	138	(1)
Shelby loam, 5 to 9 percent slopes	305	. 1
Shelby loam, 5 to 9 percent slopes, moderately eroded	253	. 1
Shelby loam, 9 to 14 percent slopes, moderately eroded	2, 364	. 6
Shelby loam, 14 to 18 percent slopes, moderately eroded	1, 461	. 4
Shelby loam, 18 to 25 percent slopes, moderately eroded	218	. 1
Shelby soils, 9 to 14 percent slopes, severely eroded	524	. 1
Shelby soils, 14 to 18 percent slopes, severely eroded	1, 309	. 3
Sperry silt loam	163	(1)
Stronghurst silt loam	173	(1)
Stronghurst silt loam, benches	75	(1)
Taintor silty clay loam	1, 027	. 3
Tama silty clay loam, 2 to 5 percent slopes	2, 630	. 7
Tama silty clay loam, 5 to 9 percent slopes	1, 775	. 5
Tama silty clay loam, 5 to 9 percent slopes, moderately eroded	4, 293	1. 1
Tama silty clay loam, 9 to 14 percent slopes, moderately eroded	4, 307	1. 2
Tama silty clay loam, 9 to 14 percent slopes, severely eroded	221	. 1
Tama silty clay loam, 14 to 18 percent slopes, moderately eroded	312	. 1
Tama silty clay loam, benches, 0 to 2 percent slopes	152	(1)
Tama silty clay loam, benches, 2 to 5 percent slopes	659	. 2
Tell silt loam, 2 to 5 percent slopes	148	(1)
Tell silt loam, 5 to 9 percent slopes	112	(1)
Tell silt loam, 5 to 9 percent slopes, moderately eroded	236	. 1
Tell silt loam, 9 to 14 percent slopes, moderately eroded	91	(1)
Udolpho loam	585	. 2
Wabash silty clay	133	(1)
Walford silt loam, benches	177	(1)
Watkins silt loam, 0 to 2 percent slopes	235	. 1
Watkins silt loam, 2 to 5 percent slopes	141	(1)
Waubeek silt loam, 2 to 5 percent slopes	268	. 1
Waubeek silt loam, 5 to 9 percent slopes, moderately eroded	382	. 1
Waukegan loam, 0 to 2 percent slopes	413	. 1
Waukegan loam, 2 to 5 percent slopes	658	. 2
Waukegan loam, 5 to 9 percent slopes	351	. 1
Waukegan silt loam, 2 to 5 percent slopes	594	. 2
Waukegan silt loam, 5 to 9 percent slopes	228	. 1
Wiota silt loam, 0 to 2 percent slopes	2, 357	. 6
Wiota silt loam, 2 to 5 percent slopes	909	. 2
Zook silty clay loam	2, 681	. 7
Zook silt loam, overwash	273	. 1
Total	373, 760	100. 0

[1] Less than 0.05 percent.

cultivated, this soil needs to be farmed on the contour. Seedbeds are difficult to prepare, and yields of corn are low. Gullies may develop unless measures are taken to prevent further erosion. Grazing needs to be controlled. *Capability unit IVe-3.*

Adair clay loam, 14 to 18 percent slopes, moderately eroded (AaE2).—The surface layer of this soil is very dark grayish-brown clay loam and is from 3 to 6 inches thick. The subsoil of reddish gritty clay is thick and distinct.

This soil generally occurs next to the Shelby soils. It is suited to hay and pasture or as a wildlife habitat. Applications of manure and commercial fertilizer are needed to establish stands of grasses and legumes, but yields generally are low. Gullies may form if grazing is not controlled. *Capability unit VIe-3.*

Adair clay loam, thin solum, 9 to 14 percent slopes, moderately eroded (AcD2).—This soil has a 3- to 6-inch surface layer of very dark gray to very dark grayish-brown clay loam. Included in the areas mapped are a few areas in which the surface layer is very dark brown to very dark gray and is as much as 12 inches thick.

This soil is suited to hay or as a wildlife habitat. However, it generally is farmed with adjoining soils. It is better suited to meadow crops than to grain, but all yields will be relatively low. Tillage needs to be done on the contour to help control erosion. *Capability unit IVe-3.*

Adair clay loam, thin solum, 14 to 18 percent slopes, moderately eroded (AcE2).—This soil has a 3- to 6-inch surface layer of very dark gray to very dark grayish-brown clay loam. On the lower part of side slopes are some areas in which the surface layer is very dark brown to very dark gray loam and is about 12 inches thick. Included in the areas mapped are small areas of Shelby soils, which have a more permeable subsoil than the Adair soil.

This soil is suited to hay or pasture. Manure and fertilizer are needed to establish stands of grass, but even if management is good, yields will be low. *Capability unit VIe-3.*

Adair soils, 9 to 14 percent slopes, severely eroded (AdD3).—These soils have been so severely eroded that in most places the present surface layer consists mainly of yellowish-red to reddish-brown, gritty, clayey subsoil material. The subsoil of reddish gritty clay is thick and distinct.

These soils have poor tilth and are difficult to cultivate. In spring, when adjacent soils are ready for plowing, these soils are too wet. In drying they become hard and cloddy. Cracks commonly develop in the surface layer.

These soils are suitable for hay or pasture. Narrow bands that occur between areas of more fertile soils are best left in grass when the adjoining soils are cultivated (fig. 11). Fertilizer and manure are needed to get a good stand of grass. Gullies may develop unless grazing is limited and measures are taken to control erosion. *Capability unit VIe-3.*

Adair soils, 14 to 18 percent slopes, severely eroded (AdE3).—These soils have been so severely eroded that in most places the present surface layer consists mainly of yellowish-red to reddish-brown, gritty, clayey subsoil material.

Plowing is difficult because these soils generally are either too wet or too dry. When dry, they become hard and crack. These soils are suitable for hay, pasture, or wildlife habitats. Commercial fertilizer and manure are needed to establish stands of grass, but yields generally are low. Gullies may form if grazing is not controlled. *Capability unit VIIe-1.*

***Figure 11.*—In the background, Adair soils, 9 to 14 percent slopes, severely eroded, are left idle when adjoining soils are farmed. In the foreground, pasture on Colo silty clay loam.**

Adair soils, thin solum, 9 to 14 percent slopes, severely eroded (AeD3).—These soils have been so severely eroded that in most places the present surface layer is reddish-brown to dark-brown, gritty clay to clay loam. In only a few places is there as much as 3 inches of the original dark-colored surface soil.

Because of the clayey surface layer, plowing or the preparation of good seedbeds is difficult. During dry periods, cracks develop in the surface layer, and in many places there is a concentration of small stones or coarse gravel on the surface.

These soils are poorly suited to row crops. However, because they occur as narrow bands on side slopes, they commonly are farmed with adjacent soils. If possible, they should be left in meadow when the adjacent soils are cultivated. Manure and fertilizer are needed to establish seedings. *Capability unit VIe-3.*

Adair soils, thin solum, 14 to 18 percent slopes, severely eroded (AeE3).—These soils have been so severely eroded that in most places the present surface layer is reddish-brown to dark-brown, gritty clay to clay loam.

These soils have poor tilth. They become hard and cloddy when dry and develop deep cracks by midsummer. They are suitable for hay and pasture or wildlife habitats. Meadow crops are better suited than close-growing grain, but all yields will be low. Manure and fertilizer are needed to establish seedings. Even then, a stand of grass is difficult to establish. *Capability unit VIIe-1.*

Adair soils, thin solum, 18 to 25 percent slopes, severely eroded (AeF3).—In a few places, 3 inches or less of the original dark-colored surface soil remains, but in most places the present surface layer consists mainly of subsoil material and is reddish-brown to dark-brown gritty clay. Gullies have formed in some areas. Included in the areas mapped are a few small areas that slope as much as 30 percent. Also included are small areas of Shelby and

Gara soils, which have a more permeable, less clayey subsoil than the Adair soils.

Tillage is difficult because of the steep slopes and the gullies. Hay, pasture, or wildlife habitats are suitable for these soils, but meadow yields will be low even if management is good. *Capability unit VIIe-1.*

Alluvial Land

Alluvial land consists of recently deposited, highly stratified sediments that have not been in place long enough for soil to develop. It is frequently flooded, and each flood adds new sediments. The sediments vary in texture but are mainly loam, sandy loam, and silt loam. Much of this land occurs on first bottoms along the Iowa River.

This land is channeled, and it contains many low natural levees, small ponds, sloughs, and small oxbow lakes. Natural drainage ranges from poor in the channels to good on the natural levees. Because of the flood hazard, this land is not suited to cultivation unless protected by levees. Land leveling may be necessary so that the oxbows and sloughs can be crossed with farm equipment.

Alluvial land (Al).—This land is nearly level. It is subject to frequent overflow and is dissected by channels that vary in size. The surface layer of light-colored or dark-colored silty or sandy material is underlain by stratified silt, sand, and clay.

This land is often wet because of flooding or ponding. It is suitable for woods, wildlife habitats, or pasture. If used for pasture, it needs to be cleared of the thick growth of young trees and underbrush. However, there are a few good stands of hardwoods on this land that should be allowed to remain. *Capability unit Vw-1.*

Amana Series

The Amana series consists of moderately well drained or somewhat poorly drained, dark-colored or moderately dark colored soils that formed from medium-textured or moderately fine textured alluvium. These soils are on nearly level or slightly undulating bottom lands along the Iowa and English Rivers, in the meander belt of streams. Consequently, they are dissected by old oxbows and former stream channels. These channeled areas are often wet or ponded. However, the hazard of overflow varies from place to place. Some areas are frequently flooded; others are protected by dikes or roads and are seldom flooded. The Amana soils are associated with the Nodaway, Lawson, and Colo soils.

Representative profile:

0 to 15 inches, black to very dark gray silt loam; friable.
15 to 48 inches, very dark grayish-brown to grayish-brown light silty clay loam; few yellowish-brown and strong-brown mottles; friable.
48 to 70 inches, gray silt loam and loam; few dark yellowish-brown and strong-brown mottles; friable.

If the Amana soils are protected from flooding and are otherwise well managed, they are productive. Their use is determined largely by the frequency and severity of flooding. Farming operations may be delayed in spring when the water table generally is high. These soils are medium or low in available nitrogen, low or medium in phosphorus, and low in potassium. They are medium acid and need lime.

Amana silt loam (Am).—This soil occurs on nearly level or slightly undulating bottom lands and is often flooded. Some streams on this soil cannot be crossed with farm machinery.

This soil commonly is farmed with the Nodaway, Lawson, and Colo soils. If protected from flooding, it can be used intensively for row crops. Some areas are used for pasture. *Capability unit 1-2.*

Amana-Lawson-Nodaway complex (An).—The soils of this complex occur in such intricate patterns that it was not practical to show them separately on the map. A representative profile of each soil is described under the heading of its respective series.

These soils have a slope of 1 percent or less and are frequently flooded. They are difficult to farm because they are dissected by old oxbows and former stream channels. These channeled areas often are wet or ponded for a period of several weeks. Land leveling is beneficial if these soils are used for crops. Some ponded areas may need surface drainage.

This complex is productive if cultivated, but it varies greatly in yields because of flooding. Some areas that have a scattered growth of trees are used for pasture. Most areas are suitable for pasture or trees. *Capability unit Vw-1.*

Atterberry Series

The Atterberry series consists of somewhat poorly drained, moderately dark colored silty soils that formed from loess. These soils occur on nearly level divides and benches on uplands in the northern part of the county. They are associated with the Fayette and Downs soils.

Representative profile:

0 to 7 inches, black to very dark gray silt loam; friable.
7 to 13 inches, dark-gray and gray silt loam; friable.
13 to 39 inches, grayish-brown silty clay loam; few yellowish-brown mottles; friable to firm.
39 to 60 inches, olive-gray silty clay loam to silt loam; common, fine, yellowish-brown and strong-brown mottles; friable; gleyed.

The Atterberry soils tend to be somewhat wet and in places need tile drainage. They are moderately permeable and have high water-holding capacity. They are low in available nitrogen, very low in phosphorus, and low in potassium. They are medium acid and need lime. Yields are favorable if management is good.

Atterberry silt loam (As).—This soil occurs on nearly level uplands in association with the Fayette and Downs soils. Included in the areas mapped are some small areas that slope as much as 5 percent.

During parts of the year, the water table is moderately high. In wet years tile drains are helpful, but in most years drainage is adequate for most crops. This soil is low in organic-matter content, and it needs additions of organic matter if good tilth is to be maintained. Under good management, it can be used intensively for corn and other row crops. *Capabiilty unit I-1.*

Atterberry silt loam, benches (At).—This soil occurs on nearly level, loess-covered benches that border large creeks and tributaries of the Iowa River. Included in the areas mapped are a few areas that slope as much as 5 percent.

This soil receives runoff from adjacent slopes and in some years is wetter than the higher lying Atterberry soil.

Diversions may be needed if the runoff from higher areas is excessive. If properly managed, this soil can be used intensively for corn and other row crops. *Capability unit I–1.*

Bassett Series

The Bassett series consists of moderately well drained, moderately dark colored soils, that developed from loamy sediments underlain by loam to clay loam glacial till. There is a distinct stone line at a depth of 10 to 20 inches. These soils occur mainly on long smooth slopes, on uplands in the northeastern part of the county. The slope ranges from 5 to 25 percent but is predominantly between 5 and 14 percent.

Representative profile:

0 to 6 inches, very dark gray loam to silt loam; friable.
6 to 14 inches, dark grayish-brown and dark-brown loam to clay loam; friable.
14 to 30 inches, brown to yellowish-brown light clay loam; few gray and strong-brown mottles; friable to firm.
30 to 60 inches, light brownish-gray to pale-brown light clay loam; strong-brown and yellowish-brown mottles; friable to firm.

Erosion needs to be controlled on these soils. The loss of their dark-colored surface layer will reduce yields and make tillage more difficult. These soils are strongly acid unless limed. They need lime if legumes are grown. They are low or very low in available nitrogen and very low in phosphorus and potassium but respond well to fertilizer. Yields are favorable if management is good.

Included in the areas mapped are small scattered areas in which the surface layer is lighter colored than normal for these soils.

Bassett loam, 5 to 9 percent slopes, moderately eroded (BaC2).—This soil has a very dark gray to very dark grayish-brown surface layer. In places plowing has mixed the grayish subsoil material with the surface layer. Included in the areas mapped are small areas of less eroded soils that have a very dark gray surface layer. These small areas are used as pasture or woodland.

This soil has high moisture-holding capacity and if well managed is moderately productive. It is used principally for corn, oats, and hay. Lime and fertilizer are needed for favorable yields. Contouring, terracing, and other practices that control erosion are needed if row crops are grown. *Capability unit IIIe-1.*

Bassett loam, 9 to 14 percent slopes, moderately eroded (BaD2).—This soil has a very dark grayish-brown surface layer. In places plowing has mixed subsoil material with the surface layer. Included in the areas mapped are small areas of soils that have a silt loam texture to a depth of 20 inches. Also included are some soils that have a 6- to 10-inch very dark gray surface layer. These less eroded areas are used as pasture or woodland.

This soil has short irregular slopes. Consequently, erosion control practices are difficult to apply where row crops are grown. The response to management is good, however, and this soil can be farmed on the contour and stripcropped to help control erosion. Because of the short irregular slopes, terraces generally are not suitable. The principal crops are corn, oats, and hay. *Capability unit IIIe–3.*

Bassett loam, 14 to 18 percent slopes, moderately eroded (BaE2).—This soil commonly has a dark grayish-brown surface layer. In most plowed areas subsoil material is mixed with the surface soil. Included in the areas mapped are small areas of soils that have a silt loam texture to a depth of 20 inches. Also included are some soils that have a very dark gray surface layer, and some uneroded soils that are used as pasture or woodland.

Control of erosion is difficult if this soil is cultivated because slopes are irregular and are moderately steep. This soil is suitable for hay and pasture. Row crops should be grown only when reestablishing hay or pasture. If row crops are grown, contouring and stripcropping are needed to help control erosion. This soil is too steep for terraces. *Capability unit IVe–1.*

Bassett loam, 18 to 25 percent slopes, moderately eroded (BaF2).—This soil has a very dark gray to very dark grayish-brown surface layer that is 3 to 6 inches thick. Included in the areas mapped are some soils that have a silt loam texture to a depth of 10 to 20 inches. A few small areas in which the slope is greater than 25 percent are also included. Gullies and severely eroded spots are common.

This soil is suited to hay and pasture. Moderate yields of hay can be expected if management is good. *Capability unit VIe–2.*

Bassett soils, 9 to 14 percent slopes, severely eroded (BeD3).—These soils have been so severely eroded that in most places the surface layer is dark grayish-brown to dark-brown light clay loam. In some places, however, about 3 inches of the original very dark gray loam surface soil remains. There are a few rocks and pebbles on the surface.

These soils become hard when dry, have poor tilth, and are difficult to work. They are suitable for hay and pasture but are occasionally used for row crops. Their response to fertilizer is less than that of the moderately eroded Bassett soils. These soils commonly occur in small areas and are often farmed with surrounding less eroded soils. If cultivated, they need additions of organic matter, but they are best left in grass for an additional year when adjacent soils are cultivated. *Capability unit IVe–4.*

Bassett soils, 14 to 18 percent slopes, severely eroded (BeE3).—In most places the surface layer of these soils is dark grayish-brown to dark-brown light clay loam. In a few places it is very dark gray loam and is about 3 inches thick. Slopes generally are irregular and short. A few areas that slope as much as 25 percent were included in the areas mapped.

These soils are low in organic-matter content and have poor tilth. They become hard when dry and are difficult to work. They have been used for cultivated crops in past years but now are used mainly for hay and pasture. Yields normally are low, even if management is good. Additions of organic matter and fertilizer are needed to establish good stands of hay or pasture. *Capability unit VIe–1.*

Bertrand Series

The Bertrand series is made up of well-drained, light-colored soils that formed from medium-textured, silty alluvium. These soils occur on second bottoms along the major streams in the county, commonly in association with

the Jackson and Koszta soils. The slope ranges from 0 to 9 percent.

Representative profile:

0 to 7 inches, dark-gray to dark grayish-brown silt loam; friable.
7 to 10 inches, dark grayish-brown to dark-brown silt loam; friable.
10 to 42 inches, dark-brown to yellowish-brown silt loam to silty clay loam; friable.
42 to 55 inches, yellowish-brown silt loam; some strata of sand; friable.

The Bertrand soils are moderately permeable, are high in moisture-holding capacity, and are low in organic-matter content. They are medium or strongly acid and need lime. They are very low in available nitrogen and low in phosphorus and potassium. The response to commercial fertilizer is fair or good. The more strongly sloping soils are readily eroded.

Bertrand silt loam, 0 to 2 percent slopes (BrA).—This soil occurs on nearly level second bottoms and generally is not subject to overflow, except during periods of abnormally high rainfall.

Although this soil tends to puddle readily, it can be used intensively for row crops. A rotation that includes grasses and legumes helps to increase the organic-matter content. If this soil is well managed, favorable yields of corn can be obtained. *Capability unit I–1.*

Bertrand silt loam, 2 to 5 percent slopes (BrB).—This is the most extensive Bertrand soil in the county. Included in the areas mapped are a few areas on which light-colored sediments have been deposited. These areas are at the base of slopes.

Control of erosion may be a problem if this soil is used for row crops. Nevertheless, favorable yields of corn can be obtained if management is good. The organic-matter content is low. *Capability unit IIe–2.*

Bertrand silt loam, 5 to 9 percent slopes, moderately eroded (BrC2).—The surface layer of this soil is dark grayish brown to dark brown when moist, but it dries to a very light color. Subsurface material commonly is mixed with the surface soil, and in places the silty clay loam subsoil is exposed. Included in the areas mapped are small areas of soils that have a thicker, darker colored surface layer than this soil.

This soil is often farmed with adjoining, less sloping soils that are intensively cropped. Control of erosion is difficult on this soil because the areas generally are small and the slopes are short. Yields of corn are moderate, however, if management is good. *Capability unit IIIe–2.*

Bremer Series

The Bremer series consists of dark-colored, poorly drained soils on second bottoms. These soils formed in moderately fine textured or fine textured silty alluvium and are slowly permeable. The slope range is 0 to 1 percent. Some areas that grade to first bottoms are occasionally flooded.

Representative profile:

0 to 21 inches, black silty clay loam; friable to firm.
21 to 35 inches, dark-gray silty clay loam to silty clay; common yellowish-brown and strong-brown mottles; firm.
35 to 45 inches, gray silty clay loam; common yellowish-brown mottles; firm.

The major limitation on these soils is wetness caused by flooding and by a high water table. Although tile drains generally function satisfactorily, planting may be delayed in spring because of wetness. These soils are high in organic-matter content and if adequately drained are productive. They are low in nitrogen and low or medium in phosphorus and potassium. They are slightly acid.

Bremer silty clay loam (Bs).—This soil is extensive in the county. It has a slope of 1 percent or less and is occasionally overflowed. It puddles readily when wet and is cloddy and hard when dry. The water table is high.

Tile functions in this soil, but in some areas surface drains are needed to remove surface water. If drained and otherwise well managed, this soil is productive and can be used intensively for row crops. Plowing often is delayed in spring because of wetness. Consequently, most areas are plowed in fall. If this soil is used intensively for crops, lime and fertilizer are needed. *Capability unit IIw–2.*

Bremer silt loam, overwash (Bt).—A profile of this soil is similar to the profile described as representative of the series, except that in most places from 4 to 20 inches of very dark brown silt loam has been deposited over the black silty clay loam. In some places, lighter colored material has been deposited.

Plowing and the preparation of seedbeds are easier on this soil than on Bremer silty clay loam, but runoff from higher areas needs to be diverted to prevent further deposition of silt. If diversions are built, this soil can be used and managed in the same way as Bremer silty clay loam. Yields of corn generally are favorable. In wet years, yields will be lowered in areas that are not protected by diversions. *Capability unit IIw–2.*

Chariton Series

The Chariton series consists of very poorly drained, dark-colored soils that occur in slightly depressed areas on stream benches and bottom lands along the English and Iowa Rivers and their tributaries. Except for one large area in section 28 of Washington Township, most areas are between 1 and 3 acres in size.

Representative profile:

0 to 14 inches, black to very dark gray silt loam; friable.
14 to 25 inches, dark-gray to gray silt loam; friable.
25 to 41 inches, black to very dark gray heavy silty clay loam to light silty clay; few, fine, dark yellowish-brown mottles; firm to very firm; gleyed.
41 to 50 inches, mottled dark-gray and yellowish-brown silty clay loam; firm; gleyed.

The Chariton soils are medium or slightly acid, very low in available nitrogen, and low in phosphorus and potassium. The response to fertilizer is fair or good. Tile drainage functions slowly in these slowly permeable soils, and surface drainage generally is needed to remove ponded water.

Chariton silt loam (Ca).—This soil occurs mainly in small areas and is often farmed with surrounding soils. The slopes are less than 1 percent or are concave. Included in the areas mapped are some areas in which the surface layer is dark grayish brown.

This soil is difficult to work. It puddles readily when wet and becomes cloddy and hard when dry. Even in drained areas, field operations commonly are delayed

either because the water table is high or the soil is ponded. Row crops are suitable if this soil is drained, but crops sometimes are short or turn yellow because of excess moisture. Yields vary but generally are moderate if management is good. This soil needs better management than the adjacent associated soils. *Capability unit IIIw-2.*

Chelsea Series

The Chelsea series consists of excessively drained sandy soils on uplands. These soils generally are parallel to river valleys and extend about 2 miles back from the valleys. The largest areas are on the south side of the Iowa River. The slope ranges from 2 to 40 percent but is mostly between 9 and 18 percent.

Representative profile:

0 to 5 inches, dark grayish-brown fine sand; loose.
5 to 25 inches, dark-brown to yellowish-brown fine sand; loose.
25 to 73 inches, yellowish-brown to brownish-yellow fine sand; few dark-brown bands of loamy sand; loose.

Combating droughtiness and controlling erosion are the major problems on these soils. Because of the very low moisture-holding capacity and low fertility, yields of crops are low. The Chelsea soils are strongly acid and are very low in available nitrogen, phosphorus, and potassium. They are suited to permanent pasture, woods, or wildlife habitats.

Chelsea fine sand, 2 to 9 percent slopes (CeB).—In wooded areas, this soil has about 1½ inches of leaf litter on the surface. In cultivated areas, the surface layer is dark grayish brown to dark brown. Most of the acreage is on uplands, but there are a few light-colored sandy areas on stream terraces.

This soil generally occurs as small areas within larger areas of other Chelsea soils and commonly is farmed with these surrounding soils. It is low in fertility and very droughty. Thus, a rotation that includes corn only once is best suited if this soil is cultivated. Christmas trees may be a profitable crop. Leaving crop residues on the surface helps to reduce wind erosion. *Capability unit IVs-1.*

Chelsea fine sand, 9 to 18 percent slopes (CeD).—The surface layer of this soil is dark grayish brown. In a few areas that are wooded, the surface is covered with about 1½ inches of leaf litter. Included in the areas mapped are a few small severely eroded areas in which the surface layer is dark brown. Sandstone bedrock is at a depth of 2 or 3 feet in a few small areas that occur in sections 15 and 22, in Lenox Township. Stone symbols identify these areas on the map.

This soil is low in fertility. It is droughty and is subject to both wind and water erosion. Consequently, little of the acreage is cultivated. This soil is suitable for permanent pasture, woods, or wildlife habitats. Existing vegetation should not be completely destroyed when pastures are renovated. The carrying capacity of pastures depends to a great extent on the amount of rainfall but generally is low. The response to fertilizer is poor or fair. *Capability unit VIIs-1.*

Chelsea fine sand, 18 to 40 percent slopes (CeG).—The surface layer of this soil varies in color, but in most places it is dark grayish brown to brown. In cultivated areas, nearly all of the original surface soil has been removed by wind or water erosion. Wooded areas are protected from erosion and have as much as 1½ inches of leaf litter on the surface.

This soil is so steep that in many places it cannot be renovated with regular farm machinery. Thus, pasture yields are low. This soil is suitable for woods or wildlife habitats, but tree planting is difficult on these steep slopes. *Capability unit VIIs-1.*

Chelsea-Fayette-Lamont complex, 5 to 9 percent slopes (CfC).—The Chelsea, Fayette, and Lamont soils occur in such small areas and are so closely associated that they are mapped together as a soil complex. They occur in steep areas that border the Iowa River and in small areas on the south side of the North English River. They developed in loose, windblown sand that in places contained some silt and clay. Included in the areas mapped are small areas of soils that have a slope range of 2 to 5 percent. For more information on these soils, see the description for each soil series in this section of the report.

About 40 to 50 percent of this complex consists of Chelsea fine sand, about 25 to 35 percent is Fayette silt loam, and nearly 10 percent is Lamont sandy loam. The rest consists of soils that are intermediate between these soils. These intermediate soils have a surface layer of loamy sand, sandy loam, or loam that is underlain by silt loam or sand.

This complex varies in water-holding capacity, is low in organic-matter content, and is low in natural fertility. Such conservation practices as contouring and terracing are difficult because slopes are irregular. Stripcropping helps to control erosion if this complex is used for row crops. Mulch tillage can be used in the more sandy areas. Lime, fertilizer, and organic matter are needed to establish stands of grass and legumes. Yields of hay and pasture commonly are good on the Fayette soil but poor on the Chelsea soil. Yields of corn generally are low on all of these soils. *Capability unit IIIs-1.*

Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes (CfD).—This complex is mainly wooded or in pasture and thus is protected from wind and water erosion.

If cultivated, these soils are readily eroded. Consequently, this complex is better suited to permanent pasture or woods. Stripcropping is important if row crops are grown. Lime, fertilizer, and organic matter are needed. Yields of corn vary but generally are low. Pastures have a low carrying capacity during midsummer, and most permanent pastures need to be renovated. *Capability unit IVe-5.*

Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes, moderately eroded (CfD2).—These soils have been used for cultivated crops and are eroded to the extent that less than 6 inches of the original moderately dark colored surface soil remains. In places the subsoil is exposed.

This complex is suited to pasture or woods, but at times it is cultivated with adjacent soils. Lime, organic matter, and fertilizer are needed to establish pastures. However, the carrying capacity of pastures is low during midsummer. *Capability unit IVe-5.*

Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes (CfE).—This complex is nearly all wooded. Thus, most areas are protected against erosion. Cleared areas are used for permanent pasture. Areas that have poor stands of trees can be cleared for pasture.

This complex is not suited to row crops but is suitable for pasture or woods. Measures to control erosion need to be taken when pastures are renovated. Applications of lime, fertilizer, and organic matter are also needed. The carrying capacity for pastures is low during most of the year, and gullies may develop if grazing is not controlled. *Capability unit VIe–2.*

Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes, moderately eroded (CfE2).—This complex has been used mainly for cultivated crops. It is eroded to the extent that there are many areas where the subsoil is exposed.

Because this complex is moderately steep and erodes rapidly if cultivated, it is better suited to permanent pasture, woods, or wildlife habitats. Yields vary but generally are low. *Capability unit VIe–2.*

Chelsea-Fayette-Lamont complex, 18 to 40 percent slopes (CfG).—This complex includes both cultivated and wooded areas. In the cultivated areas, erosion has removed all of the original surface soil. In the wooded areas, the vegetation has protected the soil from erosion.

Because of the steepness of the slopes, this complex is not suited to tilled crops. It is better suited to woods and to wildlife habitats. Some areas can be pastured, but the renovation of pastures is difficult because regular farm equipment cannot be used on many of the steep slopes. Yields of pasture are low, and gullies are likely to form if pastures are overgrazed. Existing woodlands are benefited by good woodland management. *Capability unit VIIe–3.*

Clinton Series

The Clinton series consists of light-colored, moderately well drained soils that formed in loess on convex slopes on uplands. The slope is mostly between 9 and 14 percent but ranges from 2 to 25 percent on the strongly dissected uplands in the southern part of the county.

Representative profile:

0 to 6 inches, very dark gray silt loam; friable.
6 to 10 inches, dark grayish-brown silt loam to silty clay loam; friable to firm.
10 to 38 inches, dark yellowish-brown to light yellowish-brown medium to heavy silty clay loam; firm.
38 to 66 inches, light yellowish-brown silty clay loam to silt loam; few to common gray and strong-brown mottles; firm.

The Clinton soils occupy about 30,000 acres in the county. They have moderately slow permeability and high moisture-holding capacity. They normally are medium or high in available phosphorus and low in available nitrogen and potassium. These soils are acid unless limed within the past 5 years. Lime generally is needed to establish legumes.

Most of the acreage is used for cultivated crops, but some is in pasture or trees. These soils are free of stones and pebbles. They are easy to work but erode readily if cultivated and not protected. The response to management is good.

Clinton silt loam, 2 to 5 percent slopes (ClB).—This soil occupies narrow, gently rounded, convex ridgetops on rolling or hilly uplands. The surface layer is very dark gray to dark gray silt loam. It is underlain by dark grayish-brown silt loam. A few small areas on loess-covered benches are included in the areas mapped.

Some areas are used as pasture or woodland, but most of the acreage is used for crops. Corn, oats, and hay are the principal crops. This soil is readily eroded and needs to be tilled on the contour if row crops are grown. Yields are favorable if management is good. *Capability unit IIe–2.*

Clinton silt loam, 5 to 9 percent slopes (ClC).—This soil has a 2- to 4-inch surface layer of very dark gray silt loam that is underlain by dark grayish-brown silt loam. In cultivated areas, the surface layer is very dark gray or dark gray. Included in the areas mapped are small areas on loess-covered benches.

Much of the acreage is pastured or wooded. Although this soil is readily eroded if cultivated, in most cultivated fields measures are taken to control erosion. Consequently, little of the surface soil has been lost. Row crops can be grown more frequently where fields are terraced and farmed on the contour. A mixture of grasses and legumes in the rotation will supply needed organic matter. Yields of corn are favorable if management is good. *Capability unit IIIe–2.*

Clinton silt loam, 5 to 9 percent slopes, moderately eroded (ClC2).—This soil is eroded to the extent that the 3- to 6-inch surface layer is dark-gray to dark grayish-brown silt loam. In most places subsurface material is mixed with the surface layer. Some small severely eroded spots in which the surface layer is dark grayish brown to dark yellowish brown are included in the areas mapped.

This soil has high moisture-holding capacity, but it is low in organic-matter content, and it is readily eroded. If terraced and tilled on the contour, it can be used more frequently for row crops. Corn yields are favorable if this soil is well managed. The response to lime and fertilizer is good. *Capability unit IIIe–2.*

Clinton silt loam, 9 to 14 percent slopes (ClD).—This soil has been used almost entirely for pasture or woods and thus has been protected from erosion. In areas that have not been plowed, the surface layer is about 3 inches thick and is very dark gray, and the subsurface layer is dark grayish-brown silt loam.

This soil is high in moisture-holding capacity but low in organic-matter content. It erodes readily if cultivated. It responds to good management, however, and if terraced and tilled on the contour can be used more frequently for row crops. Favorable yields of corn, oats, and hay can be expected. The rotation should include a mixture of grasses and legumes. *Capability unit IIIe–4.*

Clinton silt loam, 9 to 14 percent slopes, moderately eroded (ClD2).—This is the most extensive soil in the Clinton series. Part of the original surface layer has been removed by erosion, and the present surface layer is dark-gray to dark grayish-brown silt loam that is 3 to 6 inches thick. Subsurface material commonly is mixed with the surface soil.

This soil is friable, and it has rapid runoff because of the strong slopes. Thus, it is readily eroded. Most of the acreage has been cultivated for some time. If row crops are grown, tillage needs to be done on the contour. Row crops can be grown more frequently where fields are terraced. If management is good, favorable yields of corn can be expected. *Capability unit IIIe–4.*

Clinton silt loam, 14 to 18 percent slopes, moderately eroded (ClE2).—This eroded soil has a 3- to 6-inch surface layer of dark-gray to dark grayish-brown silt loam. In

most places subsurface material is mixed with the surface soil. Included in the areas mapped is a small acreage of a less eroded soil that is wooded and thus is protected from erosion. In these areas, the soil has a 3-inch, very dark gray surface layer and a distinct dark grayish-brown subsurface layer.

If this soil is used for corn, soil loss is high and yields are low. This soil is suitable for semipermanent hay or pasture. A row crop can be grown for 1 year, however, when hay or pastures need renovating if fields are stripcropped on the contour. *Capability unit IVe–2.*

Clinton silt loam, 18 to 25 percent slopes, moderately eroded (ClF2).—The surface layer of this eroded soil is less than 6 inches thick and is dark-gray to dark grayish-brown silt loam. Included in the areas mapped are small severely eroded areas in which the surface layer is light-colored silty clay loam. Also included are a few areas that are wooded and thus are not eroded.

Because of the moderately steep slopes, this soil is suited to permanent pasture, woods, or wildlife habitats. It generally is suitable as sites for farm ponds. *Capability unit VIe–2.*

Clinton soils, 9 to 14 percent slopes, severely eroded (CnD3).—Nearly all of the original surface layer of these soils has been removed by erosion. In most places the present surface layer consists of dark-brown to dark yellowish-brown silty clay loam, or former subsoil. Included in the areas mapped are a few small areas on streambenches.

These soils become hard when dry and puddle readily if worked when too wet. Plowing and the preparation of good seedbeds are difficult. Yields of corn are low. These soils are suitable for semipermanent hay or pasture. A row crop can be grown occasionally where fields are terraced and tilled on the contour, or a row crop can be grown for 1 year when hay or pasture needs renovation. *Capability unit IVe–4.*

Clinton soils, 14 to 18 percent slopes, severely eroded (CnE3).—These soils have a dark-brown to dark yellowish-brown silty clay loam surface layer. Erosion has removed most of the original surface soil, and in many places the subsoil is exposed.

These soils are low in organic-matter content, have poor tilth, and become cloddy and hard when dry. They are suited to hay and pasture. Generally, most areas are suitable sites for ponds. *Capability unit VIe–1.*

Colo Series

The Colo series consists of poorly drained, dark-colored soils that formed from moderately fine textured alluvium on bottom lands. These soils occur along most streams in the county. They are subject to flooding and frequently have new soil material deposited on the surface. In some places these dark-colored soils are buried beneath as much as 20 inches of recently deposited material. Some small areas of Lawson soils are included in the areas that were mapped along Old Mans Creek.

Representative profile:

0 to 30 inches, black silty clay loam; friable to firm.

30 to 50 inches, black to very dark gray silty clay loam; firm; gleyed.

50 to 60 inches, gray to grayish-brown silty clay loam; few yellowish-brown mottles; friable to firm; gleyed.

Permeability is moderately slow on the Colo soils, and tile drains are needed to reduce the wetness hazard caused by slow runoff and a high water table. If drained, these soils are productive and can be used intensively for row crops. They are low or medium in available nitrogen, medium in phosphorus, and low or medium in potassium. They are slightly acid and may not need lime. The response to management is good.

Colo silty clay loam (Co).—A profile of this soil is similar to the one described as representative of the series. Included in the areas mapped are small areas in which the depth to dark-gray or gray soil material is as little as 30 inches.

This soil is often wet as a result of flooding, slow runoff, or a high water table. It puddles readily when wet and generally becomes cloddy and hard when dry. Plowing is difficult and is often delayed in spring because of excess moisture. Consequently, this soil generally is plowed in fall when moisture conditions ordinarily are more favorable. Satisfactory outlets for drains generally are available, and tile or drainage ditches have been installed on much of the acreage. Flooding has been reduced considerably along the English River by the straightening and deepening of the channel.

This soil is productive and is well suited to crops. Large areas along the Iowa and English Rivers are used intensively for corn, soybeans, and other row crops. Areas that are frequently flooded and those along small streams commonly are used for pasture or woods. *Capability unit IIw–2.*

Colo silt loam, overwash (Cs).—A profile of this soil is similar to the one described as representative of the series, except that there is from 4 to 20 inches of dark-gray to dark-brown silt loam overwash on the surface. This sediment has been deposited by recent floods.

This soil is used intensively for row crops, particularly corn and soybeans. It can be managed in the same way as Colo silty clay loam. However, because of the texture of the surface layer, plowing is easier and the preparation of seedbeds is less difficult. Although this soil generally is not so wet as the silty clay loam, most areas are benefited by artificial drainage, provided suitable outlets are available. Diversions are needed to intercept runoff and to prevent siltation in areas that are at the base of steep slopes. *Capability unit IIw–2.*

Colo-Ely complex, 1 to 5 percent slopes (Ct).—This complex occurs along small drainageways and creeks on uplands throughout the county. The soils of this complex are described under the heading of their respective series. The Colo soil, which is dominant, occurs nearer to stream channels or waterways than the Ely soil. The Ely soil is at the base of slopes. These soils are subject to local flooding and to siltation. In places there is from 4 to 20 inches of light-colored overwash on the Colo soil. Included in the areas mapped are small areas of Judson soils, which are better drained than either of these soils.

This complex generally is wet because of overflow and a high water table. Drainageways that have a high concentration of water need to be maintained in grass to help prevent gullying. Tile is needed on each side of some drainageways, and more than one tile may be needed to provide adequate drainage in large areas (fig. 12). Diversions often are helpful in intercepting runoff from higher areas and in preventing siltation.

Figure 12.—**Wetness on the Colo-Ely complex, 1 to 5 percent slopes, will be reduced by installation of tile lines.**

Most of this complex is cropped with surrounding soils because the individual areas generally are too small to be cropped separately. The soils that are cropped separately are suitable for intensive cultivation and, if drained, are highly productive. Yields of corn generally are favorable. *Capability unit IIw–1.*

Coppock Series

The Coppock series is made up of somewhat poorly drained, dark-colored soils that have a distinct, thick, light-colored subsurface layer. These soils formed from moderately fine textured alluvium. The slope is mostly less than 3 percent.

Representative profile:

0 to 9 inches, very dark brown silt loam; friable.
9 to 24 inches, very dark gray and gray silt loam; friable.
24 to 49 inches, gray to grayish-brown and olive-brown silty clay loam; few dark reddish-brown, yellowish-brown, and brown mottles; friable to firm.
49 to 62 inches, mottled gray and yellowish-brown silty clay loam; friable to firm.

The Coppock soils need to be protected from overwash and flooding caused by runoff from adjacent higher lying soils. These soils are medium acid and commonly need lime. They are medium or low in available nitrogen, low in phosphorus, and very low in potassium. If well managed, they are productive.

Coppock silt loam (Cu).—This soil occurs at the base of slopes or at the mouth of small waterways. It has a gradient of 3 percent or less. In most areas, from 4 to 20 inches of dark-gray to dark-brown silt loam has been deposited on the surface. This material is low in organic-matter content. Water that runs off higher areas causes this soil to be slightly wet in places. Sediments deposited on the surface may cover young seedlings. In some places interceptor tile is needed to drain this soil, and in other places diversions are needed to intercept runoff.

This soil commonly occurs in small areas and is cropped with adjacent soils. Moderate yields of corn and soybeans can be expected if management is good. At times field operations are delayed slightly after rains. *Capability unit IIw–1.*

Dickinson Series

The Dickinson series consists of well-drained or somewhat excessively drained, dark colored or moderately dark colored soils on uplands. These soils formed from moderately coarse textured material and are underlain at a depth of 20 to 36 inches by coarse and fine sand. They occur in nearly level to sloping areas on river benches and on adjoining uplands. They are associated mainly with the Hagener soils.

Representative profile:

0 to 15 inches, black to very dark brown sandy loam; very friable.
15 to 30 inches, very dark grayish-brown to brown sandy loam; very friable.
30 to 52 inches, yellowish-brown and brown loamy sand; some layers of loam; loose to friable.

The Dickinson soils are rapidly permeable, have low moisture-holding capacity, and normally are droughty. They are subject to both wind and water erosion if the vegetation is thin or lacking. The nearly level areas are farmed with adjacent soils. Corn, oats, and meadow crops are grown. Yields vary but depend greatly on the amount of rainfall. These soils are strongly acid and need lime. They are low in available nitrogen and very low in available phosphorus and potassium. The response to fertilizer is fair or good, depending on the amount of moisture received.

Dickinson sandy loam, 0 to 2 percent slopes (DcA).—This soil occurs in small areas on nearly level benches. Included in the areas mapped are a few areas that have about a 12-inch deposition of light-colored material on the surface.

This soil is easily worked, but it is droughty. During the growing season, moisture generally is not adequate for cultivated crops. In dry periods, wind erosion is a hazard on bare soils. If plowed in fall, this soil may blow in spring and damage small grain or meadow crops in adjacent fields. The hazard of wind erosion is reduced if crop residues are left on the surface. Yields of corn are moderate or low even if management is good. *Capability unit IIIs–3.*

Dickinson sandy loam, 2 to 5 percent slopes (DcB).—This soil occurs on slight rises both on second bottoms along the Iowa River and on rounded crests of sloping uplands. Little water runs off because the soil is rapidly permeable.

This soil is easily worked. It dries rapidly after rains and is one of the first soils in the county to dry in spring. Leaving crop residues on the surface helps to control wind and water erosion. If row crops are grown, this soil needs to be tilled on the contour to conserve both soil and water. Yields of corn vary but often are reduced or limited because of the lack of moisture during the growing season. *Capability unit IIIs–3.*

Dickinson sandy loam, 5 to 9 percent slopes (DcC).—This soil occurs mainly on uplands near the Iowa River valley. A few moderately eroded areas in which the surface layer is very dark grayish brown are included in the areas mapped.

This soil is rapidly permeable. Consequently, runoff is slow except during periods of intense rain. The organic-matter content is low, and droughtiness is a problem even in years of normal rainfall. Most of the acreage is farmed with adjoining soils. If row crops are grown, this soil needs to be tilled on the contour. Yields of corn vary but generally are low or moderate even if management is good. Crop residues left on the surface help to control both wind and water erosion. *Capability unit IIIs–1.*

Dinsdale Series

The Dinsdale series consists of well-drained, dark-colored soils that developed from loess, which is 20 to 40 inches thick over glacial till. These soils occur on gentle convex slopes on uplands in the northern part of Washington and Lenox Townships. The slope ranges from 2 to 9 percent. The Dinsdale soils are closely associated with the Kenyon soils but are free of stones or gravel in the upper layers.

Representative profile:

0 to 17 inches, black to very dark brown silty clay loam; friable.
17 to 31 inches, dark-brown to brown silty clay loam; friable.
31 to 50 inches, brown to yellowish-brown loam; few olive-gray, strong-brown, and yellowish-red mottles; some stones and pebbles; friable to firm.
50 to 65 inches, mottled brown and gray to light-gray loam; some stones and pebbles; friable to firm.

Erosion is a hazard on these soils because of the slope. Permeability is moderate, and the moisture-holding capacity is high. These soils are medium acid and, unless limed within the past 5 years, need lime. They are low or medium in available nitrogen and low or very low in phosphorus and potassium but respond to fertilizer. They are highly productive and are well suited to corn, oats, and hay. Nearly all of the acreage is cultivated.

Dinsdale silty clay loam, 2 to 5 percent slopes (DdB).—This soil occurs on gently sloping ridges where the loess is 20 to 40 inches thick. The surface layer is free of stones and pebbles, but there are some stones and pebbles in the subsoil.

This soil is well suited to row crops, especially to corn. If used intensively for row crops, however, it needs to be terraced and tilled on the contour. *Capability unit IIe–1.*

Dinsdale silty clay loam, 5 to 9 percent slopes (DdC).—In most places the surface layer of this soil is more than 6 inches of black to very dark brown silty clay loam. There are a few eroded areas included in the areas mapped in which only 3 to 6 inches of very dark brown to very dark grayish brown surface soil remains.

This soil is susceptible to erosion and needs to be tilled on the contour if row crops are grown. It can be used more intensively for row crops if fields are terraced. The slopes are long and smooth and are suited to terracing, but the depth of cuts should be limited to avoid exposing the underlying glacial till. This soil responds to good management and is productive if fertilizer is applied and erosion is controlled. *Capability unit IIIe–1.*

Downs Series

The Downs series consists of well-drained, moderately dark colored soils derived from loess. These soils occur mainly on ridgetops and sides slopes on the uplands. A few areas are on loess-covered benches along large streams. The slope ranges from 2 to 18 percent.

Representative profile:

0 to 7 inches, very dark gray silt loam; friable.
7 to 13 inches, dark grayish-brown silt loam; friable.
13 to 37 inches, dark-brown to brown silty clay loam; few yellowish-brown mottles; friable to firm.
37 to 60 inches, brown silt loam; common yellowish-brown and gray mottles; friable.

The Downs soils are moderately permeable, have high moisture-holding capacity, and have good internal drainage. They are acid and generally need lime. Available nitrogen is low or very low, phosphorus generally is medium, and available potassium is low, but the response to fertilizer is good. Nearly all of the acreage is cultivated, and in most places average or better than average yields can be expected. Yields vary considerably, however, in steep and eroded areas.

Downs silt loam, 2 to 5 percent slopes (DoB).—This soil occupies broad divides on loess-covered uplands. Slopes are gentle, but erosion is a hazard because the surface and subsurface layers are low in organic-matter content and generally are poorly granulated.

This soil is productive if well managed. It needs to be tilled on the contour because the silty surface layer is readily eroded by runoff. If terraced it can be used intensively for row crops. Yields of corn are better than average if management is good. *Capability unit IIe–1.*

Downs silt loam, 5 to 9 percent slopes (DoC).—This soil occurs on narrow ridgetops, on side slopes, and to a lesser extent on high benches near stream valleys. In undisturbed areas, it has a 4- to 8-inch very dark gray surface layer and a somewhat distinct dark grayish-brown subsurface layer of silt loam. In most cultivated areas, the surface layer is very dark brown silt loam.

This soil is susceptible to erosion and needs to be tilled on the contour if row crops are grown. Fields that are terraced can be used more frequently for row crops. This soil is suited to terracing because of the shape and length of the slopes. Yields of corn are favorable, if management is good. *Capability unit IIIe–1.*

Downs silt loam, 5 to 9 percent slopes, moderately eroded (DoC2).—This soil occurs mainly on convex side slopes. A few areas are on benches. The surface layer consists of 3 to 6 inches of very dark brown to very dark grayish-brown silt loam. Some subsurface material commonly is mixed with the plow layer.

Most of this soil is cultivated. Row crops are suitable if tillage is on the contour. They can be grown more frequently where fields are terraced. This soil is suited to terracing because of the length and shape of the slopes. Waterways need to be shaped and seeded. The response to management is good, and yields of corn are average or above average. *Capability unit IIIe–1.*

Downs silt loam, 9 to 14 percent slopes, moderately eroded (DoD2).—This soil occurs on convex side slopes. It is the principal soil in the Downs series. In cultivated areas, the plow layer is very dark brown to very dark grayish-brown silt loam. Some of the subsurface material

commonly is mixed with the plow layer. Included in the areas mapped are small areas of soils that have a 4- to 8-inch very dark gray surface layer and a somewhat distinct dark grayish-brown subsurface layer.

Although some areas are used for pasture or woods, this soil is suited to crops. It is low in organic-matter content and is readily eroded but responds to good management. The improvement of waterways is essential because runoff is rapid. If cultivated, this soil needs to be tilled on the contour. Row crops can be grown more frequently where fields are terraced. Yields of corn are moderate. *Capability unit IIIe-3.*

Downs silt loam, 14 to 18 percent slopes, moderately eroded (DoE2).—This soil has a 3- to 6-inch surface layer of very dark brown to very dark grayish-brown silt loam. Subsurface material commonly is mixed with the surface layer. In many places the subsoil of silty clay loam is thinner than that of the typical Downs soil. Included in the areas mapped are a few small areas of a less eroded soil that has a thicker dark-colored surface layer.

Runoff is rapid on this soil, slopes are moderately steep, and tilth is somewhat poor. Consequently, this soil is susceptible to severe sheet erosion and needs to be tilled on the contour or stripcropped on the contour if row crops are grown. Generally, it is too steep to be terraced. This soil is suited to semipermanant hay or pasture. Row crops can be grown 1 year when hay or pastures need renovating. This soil is very low in nitrogen. *Capability unit IVe-1.*

Downs silt loam, benches, 2 to 5 percent slopes (DpB).—This soil occurs on gently sloping benches near large streams in the northeastern and eastern parts of the county. It has a very dark gray surface layer, about 6 inches thick, and an indistinct dark grayish-brown subsurface layer. In some places sand occurs below a depth of 45 inches.

This soil is erodible, but it responds to good management. If tilled on the contour, it is well suited to row crops. Fields that are terraced can be used more frequently for row crops without excessive soil loss. Yields of corn are better than average if management is good. In some areas, diversions are needed to intercept runoff from adjacent higher areas. *Capability unit IIe-1.*

Downs soils, 9 to 14 percent slopes, severely eroded (DsD3).—These soils are eroded to the extent that in most places the original surface layer and subsurface layer have been removed and the subsoil is exposed. In a few places there is a 3-inch dark grayish-brown surface layer, but generally the present surface layer is dark-brown silty clay loam.

These soils are easily eroded. They puddle readily when wet, and they become hard and cloddy when dry. They are very low in organic-matter content and very low in available nitrogen. Tilth is poor, and thus plowing and the preparation of seedbeds are difficult. If row crops are grown, tillage needs to be done on the contour. Where fields are terraced, row crops can be grown more frequently without excess soil loss. The convex side slopes are suited to terracing. Gullies can be shaped and seeded for waterways. These soils respond to good management. They are well suited to hay and pasture and, if well managed, are moderately productive of corn. *Capability unit IVe-4.*

Downs soils, 14 to 18 percent slopes, severely eroded (DsE3).—In most places erosion has removed most of the original surface layer and subsurface layer, and the former subsoil is exposed. In places there is a 3-inch dark grayish-brown surface layer, but generally the present surface layer is brown silty clay loam.

These soils have poor tilth and are very low in organic-matter content. They puddle readily when wet, and they become cloddy and hard when dry. Consequently, seedbeds generally are difficult to prepare. Runoff is very rapid, and waterways and diversion terraces are needed to help control erosion. Row crops are not suitable, but small grain can be grown when pastures are renovated. Additions of fertilizer and organic residues help new seedings to become established. If management is good, hay and pasture yields are moderate. *Capability unit VIe-1.*

Ely Series

The Ely series consists of somewhat poorly drained, dark-colored soils derived from mixed sediments that washed from adjacent hillsides. These soils occur either as long, narrow, irregular bands between the toe slopes and flood plains of narrow waterways on the uplands, or as alluvial fans where small streams have deposited sediments on large flood plains (fig. 13). The slope ranges from 2 to 5 percent.

Representative profile:

0 to 26 inches, very dark brown and black silt loam; friable.
26 to 40 inches, very dark gray to very dark grayish-brown and dark grayish-brown light silty clay loam; few strong-brown mottles; friable.
40 to 65 inches, mottled grayish-brown and yellowish-brown light silty clay loam and silt loam; some very dark gray and dark-gray mottles; friable.

Drainage is somewhat restricted on these soils, and in places tile drains are needed. Seepage water from adjacent uplands also helps to keep these soils wet. Siltation commonly is a problem. The amount of sediment washed from adjacent hillsides varies, but in many areas, there is light-colored overwash on the surface. Where these soils are adjacent to the sandy Hagener and Dickin-

Figure 13.—**In the foreground, typical area of Ely silt loam, 2 to 5 percent slopes, planted to corn. In the background, contouring on Downs soils helps to prevent siltation on the Ely soils.**

son soils, sand has accumulated on the surface. These areas are indicated on the soil map by sand symbols.

The Ely soils respond to good management and are productive. They are medium in available nitrogen and phosphorus and low or medium in potassium. They are slightly acid or medium acid.

Ely silt loam, 2 to 5 percent slopes (EsB).—This soil has a 20- to 30-inch surface layer of black to very dark gray silt loam. In a few included areas, the soil is black to a depth of 40 inches. Most areas have some light-colored silty overwash on the surface.

This soil generally occurs as small areas and is cropped and managed with adjacent soils. Wetness and siltation are the principal hazards because of seepage and runoff from adjacent slopes. Interceptor tile helps to remove seepage water but needs to be carefully placed to function properly. Spots where runoff water concentrates are subject to gully erosion. Diversions are needed in these areas to intercept runoff. This soil can be used intensively for row crops if it is terraced, tilled on the contour, and protected from seepage. If management is good, better than average yields of corn can be obtained. *Capability unit IIw-1.*

Fayette Series

The Fayette series consists of well-drained, moderately dark colored to light-colored soils that formed from loess on the uplands. Most areas occur near large rivers and their tributaries in the northern and eastern parts of the county. The slope ranges from 2 to 40 percent but is dominantly between 9 and 14 percent.

Representative profile:

0 to 4 inches, very dark gray silt loam; friable.
4 to 8 inches, dark grayish-brown silt loam; friable.
8 to 35 inches, brown silty clay loam; friable to firm.
35 to 58 inches, yellowish-brown silty clay loam to silt loam; friable.

Sheet erosion is a moderate or severe hazard on these soils. In many cultivated areas most of the original surface layer has been removed by erosion, and some gullies have formed. The Fayette soils are moderately permeable and have good internal drainage, but they contain little organic matter, except in the top few inches in undisturbed areas. They generally are low or very low in available nitrogen, medium or high in phosphorus, and low or very low in potassium. Most of the acreage is cultivated. The response to management is good.

Fayette silt loam, 2 to 5 percent slopes (FaB).—This soil occurs on slightly convex, moderately wide ridgetops in the hilly part of the county, near the Iowa River. If cultivated, it has a very dark brown or very dark grayish-brown surface layer and a distinct dark grayish-brown subsurface layer. In undisturbed areas, the surface layer is very dark gray silt loam. A thin layer of leaf litter is on the surface in most wooded areas.

This soil is friable, and it is easy to cultivate. It has high moisture-holding capacity and, if well managed, is productive. Most of the acreage is cultivated. Although slopes are gentle, erosion caused by runoff is a hazard, and conservation practices are needed. If row crops are grown, this soil needs to be tilled on the contour. Row crops can be grown more frequently where fields are terraced. One or two terraces can be constructed on this soil when the adjoining steeper Fayette soils are terraced. Yields of corn are above average if management is good. *Capability unit IIe-2.*

Fayette silt loam, 5 to 9 percent slopes (FaC).—This soil occurs mainly on convex side slopes and on narrow rounded ridgetops. A few areas are on the side slopes of high benches. The surface layer is very dark-brown to very dark grayish-brown silt loam. The subsurface layer is dark grayish brown and distinct.

This soil is susceptible to erosion, and it is low in organic-matter content. It is easy to cultivate, however, and most of the acreage is cultivated. If row crops are grown, tillage needs to be done on the contour. Row crops can be grown more frequently where fields are terraced. Because of the uniform length and shape of the slopes, most areas are suitable for terracing. Additions of organic matter are beneficial. *Capability unit IIIe-2.*

Fayette silt loam, 5 to 9 percent slopes, moderately eroded (FaC2).—This soil occurs mainly on convex slopes of the uplands. A few areas are on benches. The surface layer consists of 3 to 6 inches of very dark grayish-brown to dark grayish-brown silt loam to silty clay loam. In places the former subsurface layer is mixed with the surface soil, and in a few areas the brown subsoil is exposed.

This soil is readily eroded, and it is low in organic-matter content. It is easily cultivated but needs to be tilled on the contour if row crops are grown. If fields are terraced, row crops can be grown more frequently. Most of the acreage is suitable for terracing because of the uniform length and shape of the slopes. Additions of organic matter are beneficial. Gullies and some drainageways need to be shaped and seeded. Yields of corn are better than average if management is good. *Capability unit IIIe-2.*

Fayette silt loam, 9 to 14 percent slopes (FaD).—This soil occupies long convex side slopes that are uniform in shape. Wooded areas in the Amana Colonies make up much of the acreage. In these areas a thin layer of leaf litter generally covers the very dark gray surface layer. In a few areas the surface layer is very dark brown to very dark grayish-brown silt loam, and there is a distinct light-colored subsurface layer.

This soil is suited to cultivated crops, but it is readily eroded and needs to be protected. The improvement of waterways is important in cultivated areas. If row crops are grown, this soil needs to be tilled on the contour. Row crops can be grown more frequently without excessive soil loss if fields are terraced. Moderate yields of corn can be obtained. The management of wooded areas is discussed in the section "Management of Woodland." *Capability unit IIIe-4.*

Fayette silt loam, 9 to 14 percent slopes, moderately eroded (FaD2).—This soil occurs mainly on convex side slopes that are somewhat uniform in shape. The present surface layer consists of dark-gray to dark grayish-brown silt loam to silty clay loam and is from 3 to 6 inches thick. Part of the former subsurface layer is mixed with this layer. Included in the areas mapped are a few small areas of a more severely eroded soil.

This soil has poor tilth, and it is strongly sloping. Consequently, it is readily eroded and needs to be tilled on the contour if row crops are grown. Row crops can be grown more frequently where fields are terraced. Most of the acreage is suited to terracing. The reshaping and seeding of waterways will help to prevent gullying. Additions

of organic matter are beneficial. Moderate yields of corn can be obtained if management is good. *Capability unit IIIe–4.*

Fayette silt loam, 14 to 18 percent slopes (FaE).—This soil occupies long convex side slopes that, in places, are dissected by waterways. Wooded areas in the Amana Colonies make up most of the acreage. In these areas, there generally is a thin layer of leaf litter on the surface. In cultivated areas, the surface layer is very dark brown to very dark grayish-brown silt loam, and there is a distinct light-colored subsurface layer. This soil has a thinner subsoil of silty clay loam than the less sloping Fayette soils.

Waterways and diversion terraces are needed to protect this soil from erosion by runoff. In cultivated areas, additions of organic matter are beneficial. This soil is suited to hay and pasture. However, it can be used for row crops when hay and pastures need renovating, if it is tilled on the contour or stripcropped on the contour. Only moderately low yields of corn can be expected. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit IVe–2.*

Fayette silt loam, 14 to 18 percent slopes, moderately eroded (FaE2).—This soil occupies long convex side slopes that, in places, are dissected by waterways. The surface layer is dark-gray to dark grayish-brown silt loam to silty clay loam and is from 3 to 6 inches thick. In many places lighter colored subsurface soil is mixed with the surface layer. In a few spots the brown subsoil is exposed. The subsoil of silty clay loam is thinner than that of the less sloping Fayette soils.

This soil is readily eroded by runoff, and it is low in organic-matter content. It is suited to hay or pasture but can be used for row crops when hay or pastures need renovating, provided it is tilled on the contour or stripcropped on the contour. Crops respond well to additions of organic matter, fertilizer, and lime. Waterways need to be improved. Yields of corn are moderately low, even if management is good. *Capability unit IVe–2.*

Fayette silt loam, 18 to 25 percent slopes (FaF).—This soil occurs in the steep areas that border the Iowa River, mainly in the Amana Colonies. Most of the acreage is wooded and, thus, has been protected from erosion. In these areas there generally is a thin layer of leaf litter on the surface. In few areas that are used for pasture, the surface layer is dark-brown to very dark grayish-brown silt loam, and there is a distinct light-colored subsurface layer. The subsoil of silty clay loam is thinner than that of less sloping Fayette soils.

Control of runoff is a problem on this soil. Diversions are needed in pastured areas or in sparsely timbered areas to protect lower lying soils from being damaged by runoff from this soil. This soil is not suited to row crops, but it can be used for pasture. However, grazing should be controlled, particularly in pastures that have been cleared of trees and seeded. Lime and nitrogen are needed in pastures. The management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIe–2.*

Fayette silt loam, 18 to 25 percent slopes, moderately eroded (FaF2).—This soil has a dark-gray to dark grayish-brown silt loam to silty clay loam surface layer that is 3 to 6 inches thick. In most places the former subsurface layer is mixed with the surface soil. The subsoil of silty clay loam is thinner than that of the less sloping Fayette soils. Slopes are long and vary in shape. Gullies have formed in some places.

This soil is readily eroded by runoff. Diversion terraces on this soil help to prevent siltation of soils downslope. The reshaping and seeding of some waterways will help to control erosion. Row crops are not suitable, but small grain can be grown when hay or pastures need to be renovated. The carrying capacity of pastures is moderate if management is good. This soil is suitable for woods or wildlife habitats. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIe–2.*

Fayette silt loam, 25 to 40 percent slopes (FaG).—Most of this soil is used for permanent pasture or woods. In these areas the surface layer is very dark gray silt loam. In wooded areas there is a thin layer of leaf litter on the surface. The subsoil of silty clay loam is thinner than that of the less sloping Fayette soils. Some small areas of moderately eroded or severely eroded soils that have a brownish surface layer are included in the areas mapped.

This soil is readily eroded by runoff, and gullies and drainageways are common. Diversion terraces have been constructed in places to prevent siltation of lower lying soils that are suitable for crops. Pastures on this soil have low carrying capacity and are difficult to renovate because slopes are too steep for the safe use of regular farm machinery. This soil is suitable for woods and wildlife habitats. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIIe–3.*

Fayette silt loam, benches, 2 to 5 percent slopes (FbB).—This soil occurs on high benches along the Iowa River and its tributaries. Ordinarily, it is not subject to overflow. It differs from Fayette silt loam, 2 to 5 percent slopes, in that it has a sandy substratum, which normally is at a depth of 48 to 60 inches.

This soil is easy to work, but it is readily eroded by runoff. It is low in available nitrogen, is moderately permeable, and is moderate or high in moisture-holding capacity. In some years, drought is a hazard in the more shallow or more sandy areas. Corn is the principal crop. If used for row crops, this soil needs to be tilled on the contour. It can be used intensively for row crops if fields are terraced. Where this soil is adjacent to steeper soils, diversion terraces generally are needed. *Capability unit IIe–2.*

Fayette soils, 9 to 14 percent slopes, severely eroded (FsD3).—These soils occur mainly on convex slopes on strongly dissected uplands. A few areas are on the side slopes of benches. Erosion has been so severe that, in most places, the present surface layer consists of brown silty clay loam, or former subsoil. In a few areas the surface layer is about 3 inches of dark grayish-brown to dark-brown silt loam. The subsoil of silty clay loam is thinner than that of less eroded Fayette soils.

These soils are readily eroded by runoff and are gullied in some places. They are low in organic-matter content, puddle easily when wet, and become hard and cloddy when dry. Tilth is poor, and seedbeds are difficult to prepare. The development of waterways to remove excess runoff will help to control gully erosion.

These soils are best suited to hay and pasture but can be used occasionally for row crops if fields are tilled on

the contour. Row crops can be grown more frequently where fields are terraced. Applications of organic matter and fertilizer are needed to establish seedings. Yields of corn are moderately low, even if management is good. *Capability unit IVe-4.*

Fayette soils, 14 to 18 percent slopes, severely eroded (FsE3).—These soils occur on irregular complex slopes that are dissected by gullies and waterways. In a few places there is a 3-inch, dark grayish-brown surface layer, but in most places the surface layer consists of brown silty clay loam, or former subsoil. Numerous gullies, too deep to be crossed with farm machinery, have formed in some areas.

These soils are readily eroded by runoff. They have poor tilth, puddle if worked when wet, and become cloddy and hard when dry. Diversion terraces, constructed on these soils, help to prevent siltation of lower lying soils. The shaping and seeding of gullies will help to control runoff. Applications of organic matter are beneficial. These soils are suited to hay or permanent pasture. When hay or pastures need renovation, a small grain can be grown. *Capability unit VIe-1.*

Fayette soils, 18 to 25 percent slopes, severely eroded (FsF3).—These soils have been so severely eroded that in most places the present surface layer consists mainly of the former brown subsoil. In a few places there is a 3-inch, dark grayish-brown surface layer. The subsoil of silty clay loam is thinner than that of the less sloping Fayette soils.

These soils are low in organic-matter content, have poor tilth, and become cloddy and hard when dry. They are readily eroded and in some places are badly gullied. The construction of diversion terraces and the development of waterways help to control erosion in large areas. Row crops are not suitable, but yields of hay and pasture are moderate if management is good. Additions of organic matter, nitrogen, and lime are needed to establish seedings. These soils are suited to woods and wildlife habitats. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIe-2.*

Gara Series

The Gara series consists of moderately well drained, moderately dark colored soils that developed from glacial till on uplands, mainly in the southern part of the county. The slope ranges from 5 to 25 percent. These soils commonly occur on the lower part of slopes below the Ladoga soils. Narrow bands of Adair soils are included in some of the areas mapped.

Representative profile:

0 to 8 inches, very dark gray loam; friable.
8 to 12 inches, dark grayish-brown loam; friable.
12 to 47 inches, brown to yellowish-brown clay loam; some stones and pebbles; few yellowish-brown mottles; friable to firm.
47 to 60 inches, yellowish-brown loam; some stones and pebbles; a few strong-brown and grayish-brown mottles; friable to firm.

These soils are readily eroded by runoff, and gully erosion is serious in some areas. Only the gently sloping Gara soils are suited to row crops. Production varies from moderate on the gently sloping soils to very low on the severely eroded soils. All of these soils are low in organic-matter content and are very low in available nitrogen, phosphorus, and potassium. Nearly all are suitable sites for farm ponds.

Gara loam, 5 to 9 percent slopes, moderately eroded (GaC2).—This soil occurs on narrow ridgetops and on side slopes. In most places the surface layer is 3 to 6 inches of very dark grayish-brown loam. In some wooded or pastured areas, the surface layer is very dark gray. The brown subsoil is exposed in a few places.

This soil is readily eroded by runoff. Consequently, it needs to be tilled on the contour if row crops are grown. Row crops can be grown more frequently where fields are terraced. However, most areas are small, and these areas generally are farmed with adjacent soils. Additions of organic matter are beneficial. Ordinarily both lime and phosphate are needed to establish legumes. Yields of corn are moderately low, even if management is good. *Capability unit IIIe-1.*

Gara loam, 9 to 14 percent slopes, moderately eroded (GaD2).—This soil occurs on convex slopes that in many places are dissected by waterways. It has a 3- to 6-inch surface layer of very dark grayish-brown loam. In places some of the subsurface layer is mixed with the surface soil. A few areas are in permanent pasture or are wooded and, thus, have been protected from erosion.

This soil is susceptible to both sheet and gully erosion. Consequently, if row crops are grown, it needs to be tilled on the contour. Row crops can be grown more frequently where fields are terraced. In many places, however, terraces are difficult to construct because slopes are irregular, and there are numerous waterways. Additions of organic matter, lime, and fertilizer are needed to establish seedings. Yields of corn are low, even if management is good. Diversions that are built on this soil help to protect soils downslope from runoff. *Capability unit IIIe-3.*

Gara loam, 14 to 18 percent slopes, moderately eroded (GaE2).—This soil occurs on convex slopes that are dissected by a few waterways. In most places the surface layer consists of very dark grayish-brown loam and is from 3 to 6 inches thick. Some of the former subsurface layer is mixed with the surface soil. A few areas are wooded or in permanent pasture. In these areas the surface layer is darker colored than that of the unprotected soil, and the subsurface layer is more distinct. Generally, there is some leaf litter on the surface.

This soil is readily eroded by runoff. Hay or pasture is the best use, but a row crop can be grown when pastures are renovated. If row crops are grown, fields need to be tilled on the contour or stripcropped. Diversion terraces can be constructed near the base of slopes to divert local runoff, but conventional terracing is not suitable because the slopes are irregular and are dissected to some extent by waterways. Improvement of waterways helps to control erosion. Yields of corn are low, even if management is good. *Capability unit IVe-1.*

Gara loam, 18 to 25 percent slopes, moderately eroded (GaF2).—This soil commonly has a grayish-brown surface layer of loam that is 3 to 6 inches thick. In many places, most or all of the former subsurface layer is mixed with the surface soil. In a few wooded or pastured areas, the surface layer is darker colored than that of the unprotected soil, and there is an indistinct subsurface layer. The subsoil commonly is thinner than that of less eroded Gara soils. The slopes generally are too steep and irregular for the use of farm machinery.

Runoff is rapid on this soil, and barren areas are readily eroded. Thus, part of the old vegetation should be maintained when pastures are renovated. Brush control is needed in some places. Diversion terraces on this soil help to protect the soils downslope from runoff.

This soil is suited to permanent pasture, woods, and wildlife habitats, and it provides suitable sites for ponds. The management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIe–2.*

Gara soils, 9 to 14 percent slopes, severely eroded (GrD3).—These soils occur on convex slopes and commonly are dissected by gullies and waterways. There are few areas in which 3 inches or less of dark grayish-brown soil remains, but in most places the present surface layer consists of brown clay loam, or former subsoil.

These soils have poor tilth and are readily eroded. They are low in organic-matter content, puddle easily, and become hard and cloddy when dry. Tillage and the preparation of seedbeds are difficult.

These soils are best suited to hay or pasture but can be used for row crops when hay or pastures are renovated. If row crops are grown, fields need to be tilled on the contour or stripcropped on the contour to help control erosion. Terraces generally are difficult to construct because of the irregular slopes and the numerous gullies and waterways. Diversion terraces, however, will help to protect soils downslope from runoff. Nitrogen, phosphate, potash, and lime are needed to establish seedings. Additions of organic matter are also beneficial. Yields of corn are very low. *Capability unit IVe–4.*

Gara soils, 14 to 18 percent slopes, severely eroded (GrE3).—These soils occur on irregular convex slopes and are dissected by gullies and waterways. There are few areas in which 3 inches or less of dark grayish-brown soil remains, but in most places the present surface layer consists of brown clay loam, or former subsoil.

These soils have poor tilth and are readily eroded by runoff. They puddle easily and become hard and cloddy when dry. Tillage and the preparation of seedbeds are difficult.

These soils are not suited to row crops, but they can be used for pasture or intensively for hay. Oats can be used as a nurse crop when seedings are established. Fertilizer and lime are needed to establish good stands. Many areas provide good sites for farm ponds. Diversion terraces can be constructed in some places to protect soils downslope from runoff. Some areas are best suited to woods. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIe–1.*

Gara soils, 18 to 25 percent slopes, severely eroded (GrF3).—These soils occur on short concave slopes, commonly within larger areas of less sloping soils. There are a few areas in which 3 inches or less of dark grayish-brown soil remains, but in most places the present surface layer consists of brown clay loam, or former subsoil. These soils lack a subsurface layer and have a thinner subsoil than the less sloping Gara soils. Most areas are small and are often left idle when the surrounding soils are cultivated.

These soils are suited to pasture, woods, or wildlife habitats. They puddle easily when wet and become cloddy and hard when dry. Runoff is rapid because tilth is poor and slopes are steep. Additions of organic matter, fertilizer, and lime are needed to establish seedings. Control of grazing is necessary in pastured areas. The section "Management of Woodland" suggests suitable trees for planting, as well as management for woodland. *Capability unit VIIe–1.*

Givin Series

In the Givin series are somewhat poorly drained, level or nearly level, moderately dark colored soils that developed from loess. These soils occur on broad flats on uplands, in association with the Ladoga and Clinton soils.

Representative profile:

0 to 7 inches, very dark gray silt loam; friable.
7 to 12 inches, dark-gray to dark grayish-brown silt loam; friable.
12 to 27 inches, dark grayish-brown silty clay loam; few olive-brown mottles; firm.
27 to 50 inches, grayish-brown silty clay loam; strong-brown and yellowish-brown mottles; firm to friable.

Planting is often delayed on these soils because the water table commonly is moderately high in spring. Tile drainage will permit earlier field operations in wet years, but in years of normal rainfall satisfactory yields can be obtained without artificial drainage. These soils are medium acid, and they are low in available nitrogen, low or medium in phosphorus, and very low in potassium. Corn is the principal crop.

Givin silt loam (Gs).—This soil has a 6- to 10-inch very dark gray surface layer of silt loam and a lighter colored, indistinct subsurface layer. The slope is 1 percent or less, but a few small areas that slope as much as 3 percent are included in the areas mapped. Also included are a few small depressed areas in which the soil is more poorly drained than this soil. These areas are indicated on the soil map by a wet symbol.

This soil can be used intensively for row crops. It occurs within larger areas of better drained soils and, if drained, can be cultivated at the same time as the surrounding soils. Tile drainage may not increase yields but will permit earlier field operations in wet periods. A green-manure crop or a legume can be grown if the surface layer becomes difficult to work. Crops respond well to fertilizer and lime, and yields of corn are better than average if management is good. *Capability unit I–1.*

Gullied Land

Gullied land consists of moderately well drained, fine textured and moderately fine textured soils that are so dissected by active gullies that, in many places, they cannot be crossed with farm machinery. These soils developed in glacial till on irregular slopes that range from 9 to 40 percent but generally are between 15 and 20 percent. Except for small patches between gullies, the soil profile has been destroyed by erosion. In some places this land is associated with the Lindley and Keswick soils; in others it occurs with the Adair soils.

Gullied land (Gu).—This miscellaneous land type consists of soils that are dissected by many active eroding gullies. Gullies have formed in plow furrows, animal trails, wagon ruts, natural drainageways, and old crop rows that extend up and down the slope. They form barriers that subdivide fields into areas so small that generally these areas cannot be farmed efficiently. In most

places this gullied land is idle. It commonly has only a thin cover of vegetation, or it is barren. It cannot be used for crops or pasture without extensive reclamation but will provide excellent habitats for wildlife if seeded to grasses and legumes or if trees are planted. Some areas need to be fenced to prevent their being grazed by livestock. Runoff can be intercepted before it reaches some of these gullied areas if diversions are constructed on soils upslope. *Capability unit VIIe-2.*

Hagener Series

The Hagener series consists of excessively drained, moderately dark colored soils that formed from local sand deposited by wind. These soils occur primarily on the uplands and on a few benches near the Iowa River. The slope ranges from 0 to 25 percent.

Representative profile:

0 to 9 inches, very dark grayish-brown fine sand; loose.
9 to 23 inches, dark yellowish-brown fine sand; loose.
23 to 54 inches, yellowish-brown fine sand; loose.

The Hagener soils hold little moisture and are very droughty. They are subject to both wind and water erosion. The less sloping soils are often cropped with adjacent soils, and the steeper soils are used mainly for pasture. These soils are slightly acid or medium acid. They are very low in available nitrogen, phosphorus, and potassium.

Hagener fine sand, 0 to 2 percent slopes (HaA).—This soil occurs mostly in small areas on second bottoms and on benches. The surface layer is very dark gray to very dark grayish-brown fine sand. Small areas of soils that have a surface layer of loamy fine sand and sandy loam are included in the areas mapped.

This soil loses much moisture by deep percolation and, therefore, is very droughty. In most years corn growing on this soil turns brown, while corn growing on surrounding less sandy soils remains green. Wind erosion is a serious hazard in spring if this soil is left unprotected. To prevent soil blowing early in spring, seed a cover crop in fall, or leave crop residues on the surface. In years when rainfall is timely and adequate during the growing season, moderate yields of corn can be obtained if management is good, but generally yields are low. *Capability unit IVs-1.*

Hagener fine sand, 2 to 5 percent slopes (HaB).—This soil occurs on rounded ridges on uplands and on slight rises on second bottoms or on benches. The surface layer is very dark gray to dark grayish-brown fine sand. A few soils that have a surface layer of sandy loam are included in the areas mapped.

Wind and water erosion are serious hazards if row crops are grown. To help control erosion, till on the contour and leave crop residues on the surface. If rainfall is above normal or timely during July, moderate yields of corn can often be obtained, but generally yields are low. Grass and legumes are difficult to establish because this soil is droughty. *Capability unit IVs-1.*

Hagener fine sand, 5 to 9 percent slopes (HaC).—This soil occurs on convex ridge crests and on side slopes. The surface layer is very dark grayish-brown fine sand. Included in the areas mapped are a few areas in which the surface layer is sandy loam. Many of these included areas are large enough to be farmed separately.

This soil is subject to both wind and water erosion. It needs to be tilled on the contour if row crops are grown. Crop residues left on the surface help to control wind erosion. A cover crop of winter rye also helps to reduce the erosion hazard. Grasses and legumes generally are difficult to establish but should be left on this soil as long as they are productive. However, rodents often become active and harm old seedings. Yields of corn are low. *Capability unit IVs-1.*

Hagener fine sand, 9 to 14 percent slopes (HaD).—This soil occurs on side slopes on uplands, principally near the Ohio River. The surface layer is very dark gray to very dark grayish-brown fine sand. Much of the acreage has been protected from erosion by vegetation. However, a few severely eroded areas have been included in the areas mapped, and in these the present surface layer consists of dark-brown to dark yellowish-brown fine sand, or former subsoil. Also included are a few small areas in which the surface layer is sandy loam. Blowouts occur in some places. These areas are indicated on the soil map by a blowout symbol.

If cultivated, this soil is subject to severe erosion. It is best suited to semipermanent grass and legume meadow. After 3 or 4 years of meadow, however, the stand generally becomes poor because of rodent activity and needs to be reestablished. Row crops can be grown for 1 year when hay or pastures are renovated, if fields are tilled on the contour or stripcropped on the contour. Yields of corn are very low, even if management is good. In some years, only two cuttings of hay can be obtained. Control of grazing is necessary in areas that are used for pasture. *Capability unit VIs-1.*

Hagener fine sand, 14 to 25 percent slopes (HaE).—This soil occurs on convex slopes on uplands near the Iowa River. Although the slope is as much as 25 percent in some places, in most places it is between 14 and 18 percent. The surface layer of fine sand is very dark grayish brown, except in a few severely eroded areas that were included in the areas mapped. In these areas it is dark brown to dark yellowish brown. Gullies have formed in places.

Both water and wind will erode this soil if the vegetation is thin or the surface is barren. Thus, the vegetation in permanent pastures should not be completely destroyed when pastures are renovated. Grasses and legumes are difficult to establish and can be allowed to remain as long as they are productive. In well managed pastures, grazing is stopped in midsummer when pasture yields are low. This soil is suited to permanent pasture, woods, and wildlife habitats. *Capability unit VIIs-1.*

Hagener-Tama complex, 2 to 5 percent slopes (HgB).—This complex occurs on undulating narrow ridges of tabular divides. The soils of this complex are so closely associated in small areas that they are mapped together as a soil complex. About 35 to 45 percent of the acreage is Hagener soil, and from 20 to 30 percent is Tama soil. The rest consists of soils that are intermediate between these two soils. The actual proportions of each soil varies, however, from area to area. In most areas there is a 6- to 12-inch dark-colored surface layer. For more detailed information on the Hagener and Tama soils, see the individual description for each soil under the heading of its respective series.

This complex is erodible and droughty. Conservation practices to control erosion are difficult to apply because the soils are sandy and slopes are irregular.

Generally, this complex is used and managed in the same way as the adjacent soils. Tilling on the contour helps to control erosion if row crops are grown. Terraces are suitable in a few areas where the Tama soil predominates but are difficult to maintain in other areas. Yields of corn vary from year to year because the soils are droughty, but ordinarily yields are lower than average for the Tama soils and higher than average for the Hagener soils. *Capability unit IIIs-3.*

Hagener-Tama complex, 5 to 9 percent slopes (HgC).—This complex occurs on convex ridge crests and on side slopes. The surface layer is dark colored and is from 6 to 12 inches thick.

Most areas are pastured or have been cultivated for only a short time. This complex is susceptible to both wind and water erosion. In places young crops may be injured by blowing sand. Tilling on the contour or stripcropping on the contour helps to control erosion if row crops are grown. Terraces can be constructed in some places. Yields of corn vary, but, if rainfall is timely or above normal, moderate yields can be obtained, provided management is good. *Capability unit IIIs-1.*

Hagener-Tama complex, 5 to 9 percent slopes, moderately eroded (HgC2).—This complex occurs on irregular, convex side slopes. The Tama soil for the most part has a 3- to 6-inch surface layer, but in some areas that are downslope, sandy material has been deposited on the surface. In some places, the Hagener soil has been severely eroded.

Most of the acreage is cultivated. The soils of this complex are readily eroded by runoff. The Hagener soil is also subject to wind erosion, and young crops may be damaged by blowing sand. Tilling or stripcropping on the contour helps to control erosion if row crops are grown. Terraces may be difficult to construct and maintain because slopes are irregular and some areas are sandy. Yields of corn depend largely on the timeliness of rainfall and on the amount received during midsummer, but yields are often low. *Capability unit IIIs-1.*

Hagener-Tama complex, 9 to 14 percent slopes, moderately eroded (HgD2).—This complex occurs on irregular, convex side slopes. The Tama soil has a 3- to 6-inch surface layer. In places the Hagener soil is severely eroded, and in some places there are sand blowouts. Blowouts are indicated on the soil map by a blowout symbol. Included in the areas mapped are a few areas in which the surface layer is from 6 to 12 inches thick. These areas commonly are in permanent pasture.

This complex is subject to both wind and water erosion, and it is gullied in some places. Tilling on the contour or stripcropping on the contour helps to control erosion if row crops are grown. This complex generally is not terraced, because slopes are irregular and some areas are sandy. Yields of corn vary but normally are low. A row crop can be grown for 1 or 2 years when hay or pastures need renovating. *Capability unit IVe-5.*

Hagener-Tama complex, 14 to 18 percent slopes, moderately eroded (HgE2).—This complex occurs mainly on irregular, convex side slopes. The Tama soil has a dark-colored surface layer that is from 3 to 6 inches thick. The Hagener soil has a lighter colored surface layer than the Tama soil and is more eroded. Included in the areas mapped are a few small areas in which the slopes are short and are as steep as 25 percent.

This complex is readily eroded by runoff, and in some places gullies have developed. These gullies can be shaped to form waterways and seeded. Areas that are bare of vegetation are subject to wind erosion. This windblown sand is likely to damage young crops. If row crops are grown, tilling on the contour or stripcropping on the contour helps to control erosion. A row crop can be grown when hay or pastures need renovating. Yields of corn vary but normally are low. The carrying capacity of pastures is generally low during midsummer. Control of grazing is necessary to prevent pastures from being overgrazed. *Capability unit VIe-2.*

Hopper Series

The Hopper series consists of well-drained, light-colored soils that formed from loess high in lime. These soils occur both on complex slopes, on uplands on the south side of the Iowa River, and on long narrow ridges that extend in a northwesterly to southeasterly direction in Hilton and Lenox Townships. The slope ranges from 9 to 25 percent. Included in the areas mapped are a few areas in which the surface layer is slightly darker colored than that of the Hopper soils, and also a few areas of Chelsea fine sand. The sandy areas are indicated on the soil map by sand symbols.

Representative profile:

0 to 8 inches, dark-brown to brown silt loam; very friable.
8 to 23 inches, yellowish-brown silt loam; very friable.
23 to 60 inches, yellowish-brown to brown silt loam; very friable; calcareous.

These soils are readily eroded by runoff and in most places have lost all of their original dark-colored surface layer. They are low in organic-matter content and are very low in available nitrogen, medium in available phosphorus, and very low in potassium. They are neutral or slightly calcareous and do not need lime. In some severely eroded areas, lime concretions occur on the surface. In these areas the available phosphorus generally is lower than is typical. The Hopper soils are not extensive in the county but are important wherever they occur.

Hopper silt loam, 9 to 14 percent slopes, moderately eroded (HoD2).—This soil occurs in a complex pattern on narrow ridgetops, on ridge crests, and on convex side slopes. It is dissected by drainageways. The surface layer is dark-brown to brown silt loam. Included in the areas mapped are a few acres of soils that have been severely eroded and that have a yellowish-brown surface layer. Also included are a few less sloping soils.

This soil is readily eroded by runoff. Sheet erosion is common. Tilling on the contour or stripcropping on the contour helps to control erosion if row crops are grown. Row crops can be grown more frequently where fields are terraced. Some small waterways can be eliminated by the construction of properly designed terraces. Yields of corn are moderate, provided management is good. *Capability unit IIIe-4.*

Hopper silt loam, 14 to 18 percent slopes, moderately eroded (HoE2).—This soil occurs on irregular, convex side slopes. The surface layer consists of brown to dark-brown silt loam. Sheet erosion caused by runoff is a serious hazard, and a few gullies have formed.

Alfalfa grows well on this soil. Additions of phosphate are beneficial in establishing alfalfa stands. Row crops can be grown for 1 year if fields are stripcropped on the contour. Yields of corn are moderate, provided management is good. Diversion terraces that are constructed on this soil help to protect soils downslope from runoff. *Capability unit IVe-2.*

Hopper silt loam, 14 to 18 percent slopes, severely eroded (HoE3).—This soil occurs on convex side slopes and, in places, is dissected by waterways. In some areas remnants of the original dark-brown to brown surface soil remains, but in most places the present surface layer is yellowish-brown silt loam, or former subsoil. Hard concretions of lime commonly occur on or near the surface.

Sheet erosion is a severe hazard on this soil, and some gullies have formed. These gullies can be shaped to form waterways and seeded. Diversion terraces, constructed on this soil, help to protect soils downslope from runoff. This soil is suited to hay or pasture. Alfalfa grows well and is benefited by additions of phosphate. Oats can be grown when hay or pastures need renovating. Grazing needs to be controlled to prevent pastures from being overgrazed. *Capability unit VIe-1.*

Hopper silt loam, 18 to 25 percent slopes, moderately eroded (HoF2).—This soil occurs on irregular, convex side slopes. In most places, the surface layer consists of dark-brown to brown silt loam. The subsoil is very thin, and concretions of lime occur near the surface. Included in the areas mapped are a few small wooded or pastured areas in which the surface layer is very dark grayish brown. Also included are a few small areas of severely eroded soils that have a yellowish-brown surface layer.

This soil is readily eroded by runoff and is gullied in some places. It is suitable for permanent pasture, woods, or wildlife habitats. Grazing needs to be controlled in pastures in order to maintain a good vegetative cover. The renovation of pastures is difficult because some slopes are too steep for the use of farm machinery. Diversion terraces, built in pastured or sparsely timbered areas, help to protect the soils downslope from runoff. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIe-2.*

Jackson Series

The Jackson series consists of moderately well drained or somewhat poorly drained, moderately dark colored soils that formed from water-laid sediment that is low in content of sand. These soils occur on the nearly level to gently sloping second bottoms throughout the county.

Representative profile:

0 to 6 inches, very dark gray silt loam; friable.
6 to 11 inches, dark grayish-brown silt loam; friable.
11 to 43 inches, brown and grayish-brown silty clay loam; few dark yellowish-brown and strong-brown mottles; friable.
43 to 70 inches, grayish-brown and light grayish-brown silty clay loam and silt loam; many strong-brown mottles; friable.

These soils are often wet in spring when the water table is moderately high. In wet years, tile drains will permit field operations to be undertaken earlier. Tile is also needed in some areas to prevent crops from being damaged by wetness. These soils are medium acid and need lime. They are very low in available nitrogen, low or medium in phosphorus, and low or very low in potassium. They are not extensive in the county and are often farmed with adjoining soils.

Jackson silt loam (Ja).—This soil occurs on nearly level bottoms and on gently sloping escarpments adjacent to these areas. In most places the surface layer is dark-gray silt loam. In places some of the former subsurface soil is mixed with the surface soil, and the present surface layer is very dark grayish brown. Included in the areas mapped are a few gently sloping areas in which a few inches of lighter colored material has been deposited on the surface.

Wetness is a slight limitation on this soil. Generally, there is little or no runoff during rains. The water table is moderately high in spring but drops considerably by midsummer. Tile drainage is needed in level or nearly level areas and in fields that are adjacent to more poorly drained soils. This soil is well suited to row crops. Yields of corn are above average, provided management is good. A rotation that includes grasses and legumes helps to improve tilth and to increase the rate of water intake. Additions of organic matter are also beneficial. *Capability unit IIw-4.*

Judson Series

The Judson series consists of well drained or moderately well drained, dark-colored soils that formed from local alluvium washed from higher lying loessal soils. These soils occur on gently sloping or slightly concave low foot slopes or on nearly level fans, where waterways empty onto the bottom lands. The slopes range from 2 to 6 percent.

Representative profile:

0 to 25 inches, very dark brown silt loam; friable.
25 to 38 inches, very dark grayish-brown silt loam to silty clay loam; friable.
38 to 50 inches, very dark grayish-brown and dark-brown silty clay loam; friable.

These soils receive runoff water from soils upslope during periods of intense rainfall. This water does not remain on the surface for long periods. Much of it drains into these soils. Lighter colored soil material, eroded from soils upslope, is often deposited on the Judson soils. In some years young crops are covered, and replanting is necessary. The Judson soils are medium acid, medium in available nitrogen, and low or medium in available phosphorus and potassium. They can be used intensively for row crops if runoff is controlled.

Judson silt loam, 2 to 6 percent slopes (JuB).—Although the slope ranges from 2 to 6 percent, in most areas it is about 3 percent. This soil ordinarily has a thick, very dark brown silt loam surface layer, but in many places some lighter colored silt loam or loam, which is low in organic-matter content, has been deposited on the surface. A few small areas of a soil that has a lighter colored surface layer than this soil are included in the areas mapped These areas are downslope from the Fayette soils.

This soil is susceptible to both rill and gully erosion. It can be protected from runoff and siltation if diversion terraces are constructed on adjacent higher lying soils. This soil is well suited to row crops, but if row crops are grown, fields should be tilled on the contour or stripcropped on the contour to help to control erosion. Yields

of corn are above average. Individual areas are small and are generally farmed with adjoining soils. *Capability unit IIe-1.*

Kenyon Series

The Kenyon series consists of moderately well drained, dark-colored soils that formed from medium-textured sediment over glacial till. These soils occur on convex slopes on uplands in the northeastern part of Washington and Lenox Townships. The slope ranges from 2 to 14 percent but is mostly between 3 and 7 percent.

Representative profile:

0 to 12 inches, very dark brown loam; friable.
12 to 18 inches, dark-brown loam; friable.
18 to 51 inches, dark-brown and brown loam; some stones and pebbles; a few yellowish-brown and strong-brown mottles; slightly firm.
51 to 60 inches, brown and gray loam; some stones and pebbles; common yellowish-brown and strong-brown mottles; slightly firm.

Erosion caused by runoff is a serious hazard on these soils. In some eroded areas, rocks and pebbles occur on the surface. The Kenyon soils are among the best soils in the county for general agriculture. If well managed, the less sloping soils are highly productive. Many areas are small, but some are large enough to be farmed separately. These soils are strongly acid, and they are low or very low in available nitrogen and very low in phosphorus and potassium.

Kenyon loam, 2 to 5 percent slopes (KnB).—This soil occurs on convex slopes in high areas and on poorly defined short side slopes adjacent to nearly level areas, on the uplands. The surface layer is black to very dark brown friable loam and is from 10 to 12 inches thick. Included in the areas mapped are some areas in which the silty material is as much as 15 inches thick over the glacial till. Also included is a small acreage in which the surface layer is thin and the subsurface layer is light colored.

This soil is readily eroded by runoff. Consequently, it needs to be tilled on the contour if row crops are grown. If terraced, it can be used intensively for row crops. Individual areas generally are small and are often farmed with adjoining soils. Yields of corn are better than average if management is good. *Capability unit IIe-1.*

Kenyon loam, 5 to 9 percent slopes (KnC).—This soil occurs on poorly defined short side slopes in undulating high areas on the uplands. It has a black to very dark brown surface layer that is 10 to 12 inches thick. A few areas are in permanent pasture, but most areas have been cultivated.

This soil is readily eroded by runoff. Consequently, if row crops are grown, it needs to be tilled on the contour, stripcropped on the contour, or terraced. Row crops can be grown more frequently where fields are terraced. Some areas are large and can be farmed separately; others are farmed with adjoining soils. Yields of corn are favorable if management is good. *Capability unit IIIe-1.*

Kenyon loam, 5 to 9 percent slopes, moderately eroded (KnC2).—This soil occurs on poorly defined, short, convex side slopes on undulating high uplands. The surface layer consists of 3 to 6 inches of very dark brown to very dark grayish brown loam. In a few eroded areas, rocks or stones occur on the surface.

This soil is readily eroded by runoff. Consequently, if used for row crops it needs to be tilled on the contour, stripcropped on the contour, or terraced. Row crops can be grown more frequently where fields are terraced. Where terraces are constructed, the depth of the cuts should be limited so as not to expose the subsoil, which is low in fertility. Yields of corn are favorable if management is good. *Capability unit IIIe-1.*

Kenyon loam, 9 to 14 percent slopes, moderately eroded (KnD2).—This soil occurs as discontinuous narrow bands on short convex slopes, below undulating uplands. The surface layer is very dark brown to very dark grayish-brown loam and is from 3 to 6 inches thick. Some soils that have a thicker dark-colored surface layer are included in the areas mapped. Also included are a few severely eroded spots in which rock and stones occur on the surface. The individual areas of this soil are small and commonly are farmed with adjoining soils.

This soil is readily eroded by runoff and is dissected in places by waterways. Some of these waterways can be shaped and seeded. If row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced. Row crops can be grown more frequently where fields are terraced. Yields of corn are moderate if management is good. *Capability unit IIIe-3.*

Keomah Series

The Keomah series consists of somewhat poorly drained, light-colored soils that developed from loess. These soils occur on nearly level broad divides on uplands. They are of minor extent in Iowa County.

Representative profile:

0 to 7 inches, dark grayish-brown and dark-gray silt loam; friable.
7 to 14 inches, grayish-brown and dark-gray silt loam; friable.
14 to 39 inches, brown silty clay loam; few or common dark yellowish-brown, strong-brown, and gray mottles; firm.
39 to 63 inches, grayish-brown silty clay loam to silt loam; many yellowish-brown, strong-brown, and light-gray mottles; firm to friable.

These nearly level soils have little or no runoff. The water table is moderately high, and the subsoil absorbs water slowly. In spring, farm operations may be delayed because of wetness. Artificial drainage is beneficial in wet years. If properly installed, tile will function. These soils are low in organic-matter content and are medium acid. They are very low in available nitrogen, low or very low in phosphorus, and very low in potassium.

Keomah silt loam (Ko).—This soil occurs on nearly level ridgetops. In most places part of the light-colored subsurface soil is mixed with the surface layer. Individual areas of this soil are small and are surrounded by the better drained Clinton soils. Most of the acreage is cultivated.

This soil is wet during periods of high rainfall because runoff is slow and the water table is moderately high. It puddles readily if worked when too wet. Consequently, field operations are sometimes delayed. In some places crops are affected by wetness. Areas in which tile drains have been installed are more easily farmed with adjoining soils. A rotation that includes grasses and legumes helps to improve tilth and to increase the rate of water intake. Additions of organic matter are also beneficial. Yields of

corn are better than average, if management is good. *Capability unit IIw-4.*

Keswick Series

The Keswick series consists of moderately well drained soils that formed from weathered reddish, gritty clay material of glacial origin. These soils occur as narrow bands on convex side slopes, on uplands. They are downslope from the Clinton and Ladoga soils and upslope from the Lindley and Gara soils. The slope ranges from 9 to 25 percent. A few small areas of Lindley and Clinton soils are included in the areas mapped.

Representative profile:

0 to 6 inches, very dark grayish-brown loam; friable.
6 to 13 inches, brown loam; few strong-brown mottles or oxides; friable.
13 to 33 inches, yellowish-red, dark-brown to brown, and strong-brown clay loam to gritty clay; firm.
33 to 65 inches, dark yellowish-brown and yellowish-brown clay loam; a few strong-brown and grayish-brown mottles; firm.

The Keswick soils are readily eroded by runoff and are gullied in some places. They have a slowly permeable subsoil, and some areas are seepy in spring. The organic-matter content is low. These soils are medium or strongly acid, and they are low or very low in available nitrogen, phosphorus, and potassium. They are poorly suited to row crops but can be used for hay and pasture. Farm ponds to supply water for livestock can be constructed in these soils.

Keswick loam, 9 to 14 percent slopes, moderately eroded (KsD2).—This soil occurs mainly as narrow bands on convex side slopes. In places it occupies entire short side slopes. The surface layer consists of 3 to 6 inches of very dark grayish-brown loam. In some areas the subsurface layer is mixed with the surface layer, and in places the subsoil of reddish gritty clay is exposed. Included in the areas mapped are small areas in which the surface layer is very dark gray and is about 4 inches thick and the subsurface layer is distinct and lighter colored. Also included are a few areas of less sloping soils.

This soil is readily eroded by runoff, and in places it is dissected by waterways. It is low in organic-matter content, has poor tilth, and is difficult to cultivate. Some areas are seepy in spring. The subsoil is slowly permeable, and field operations are often delayed during wet periods. This soil is best suited to hay or pasture. A row crop can be grown for 1 year when hay or pastures need renovating. Tilling on the contour or stripcropping on the contour helps to control erosion when a row crop is grown. Yields of corn vary but are often low. *Capability unit IVe-3.*

Keswick loam, 14 to 18 percent slopes, moderately eroded (KsE2).—This soil occurs as narrow bands on irregular, convex side slopes. The surface layer of very dark grayish-brown friable loam is 3 to 6 inches thick. In a few areas the subsoil of gritty, yellowish-red clay is exposed. Included in the areas mapped are small areas of a soil that has a thin, very dark gray surface layer and a distinct light-colored subsurface layer.

This soil is adjacent to higher lying loessal soils and at times is seepy near the upper part of slopes. It is low in organic-matter content, has poor tilth, and is difficult to work. Cultivated areas are readily eroded by runoff, and gullies are common. The shaping and seeding of gullies to form waterways will help to control further erosion. This soil is suited to pasture and to wildlife habitats. Additions of organic matter, fertilizer, and lime are needed to establish pasture stands. The carrying capacity of pastures is moderate, but grazing needs to be controlled. *Capability unit VIe-3.*

Keswick loam, 18 to 25 percent slopes, moderately eroded (KsF2).—This soil has a 3- to 6-inch surface layer of brown to very dark grayish-brown loam. In many places the former subsurface layer is mixed with the surface soil. Included in the areas mapped are a few timbered areas in which the surface layer is darker colored than that of this soil, and there is a distinct brown subsurface layer.

This soil is readily eroded by runoff if vegetation is lacking. Diversion terraces are needed to divert water away from gullied areas. Although most of the acreage has been cultivated, this soil is now used mainly for permanent pasture. The carrying capacity of pastures is low, however, and control of grazing is necessary. When pastures are renovated, excessive soil loss can be prevented if part of the old vegetation is allowed to remain while new vegetation is being established. The removal of brush is necessary in some areas. This soil is suited to pasture, woods, and wildlife habitats. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIIe-1.*

Keswick soils, 9 to 14 percent slopes, severely eroded (KwD3).—These soils occur on short, convex side slopes and commonly are dissected by gullies and waterways. They are so severely eroded that in most places the present surface layer consists of brown or yellowish-red gritty clay, or former subsoil. In a few places about 3 inches or less of brown loam or clay loam remains. The original brownish subsurface layer is mixed with the plow layer, or it is lacking.

These soils absorb moisture slowly and may be seepy in spring. They are low in organic-matter content, have poor tilth, and puddle easily when wet. When dry they become cloddy and hard, and by midsummer deep cracks have formed in the surface layer. Erosion is a serious hazard in cultivated areas. The shaping and seeding of gullies and waterways will help to prevent further soil loss. These soils are suited to hay and pasture but need additions of organic matter, fertilizer, and lime when stands are established. Control of grazing is necessary because the carrying capacity of pastures is somewhat low. *Capability unit VIe-3.*

Keswick soils, 14 to 18 percent slopes, severely eroded (KwE3).—These soils occur on short, convex side slopes or as narrow bands on side slopes. They are so severely eroded that in most places the present surface layer consists of brown or yellowish-red gritty clay, or former subsoil. In a few areas about 3 inches of brown loam or clay loam remains. Stones and pebbles are common.

These soils are readily eroded by runoff and are dissected by waterways and gullies. The shaping and seeding of gullies will help to prevent further erosion. A temporary diversion terrace, built above the gullies, will divert water away from these areas until seedings are established. Trees can be planted in large gullies. When pastures need renovation, excessive soil loss can be prevented if old stands are not completely destroyed while new vegetation is being established. Control of grazing is necessary because the carrying capacity of pastures is

low. These soils are suited to woods and wildlife habitats. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIIe-1.*

Keswick soils, 18 to 25 percent slopes, severely eroded (KwF3).—These soils occur on irregular, convex short slopes or as narrow bands on side slopes. They are so severely eroded that in most places the present surface layer consists of brown or yellowish-brown gritty clay, or former subsoil. In a few areas about 3 inches of brown loam or clay loam remains.

These soils are readily eroded by runoff. They are dissected by gullies and waterways, which continue to enlarge. The organic-matter content is low, and tilth is poor. The surface layer becomes hard and cloddy when dry, and deep cracks form during dry periods. Consequently, cultivation is difficult. Some areas are too steep or too eroded for the efficient use of farm machinery. These soils are suitable for permanent pasture, woods, or wildlife habitats. When pastures are renovated, excessive soil loss can be prevented if part of the old vegetation is maintained while new vegetation is being established. The carrying capacity of pastures is very low, and careful control of grazing is necessary. The management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIIe-1.*

Koszta Series

The Koszta series consists of somewhat poorly drained, moderately dark colored soils that occur mainly on nearly level second bottoms along the major streams in the county. A few areas occur where low second bottoms merge with the flood plain. These areas are subject to more frequent overflow than normal. The Koszta soils formed from medium-textured or moderately fine textured alluvium. In some areas the subsoil is slightly finer textured than typical. The slope ranges from 0 to 3 percent but generally is between 0 and 1 percent.

Representative profile:

0 to 9 inches, very dark brown silt loam; friable.
9 to 14 inches, very dark grayish-brown to dark grayish-brown silt loam; light brownish gray when dry; friable.
14 to 29 inches, grayish-brown silty clay loam; common yellowish-brown mottles; friable.
29 to 62 inches, mottled gray and yellowish-brown silty clay loam; friable to firm.

Farming operations on these soils may be delayed in spring because of wetness. In years that are wetter than normal, a reduction in yields can be expected unless tile drainage is adequate. The Koszta soils are medium acid and need lime. They are low in available nitrogen, low or medium in phosphorus, and very low in potassium. They have good moisture-holding capacity and are productive if management is good. They are not susceptible to erosion. The individual areas are small.

Koszta silt loam (Kz).—This soil occurs with the Nevin, Wiota, and Jackson soils on second bottoms that have a gradient of 1 percent or less. The surface layer of silt loam is gray to grayish brown when dry.

This soil can be used intensively for row crops. Tilth is improved in places by additions of organic matter. Tile drains are needed in some areas because the water table is moderately high during parts of the year. Yields of corn are better than average if management is good. *Capability unit I-1.*

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Ladoga Series

The Ladoga series consists of moderately well drained, moderately dark colored soils derived from loess. These soils occur on uplands and on benches along streams. They make up the second largest acreage in the county. The slope ranges from 2 to 18 percent.

Representative profile:

0 to 5 inches, very dark grayish-brown silt loam; friable.
5 to 10 inches, very dark grayish-brown and dark grayish-brown silt loam to silty clay loam; friable.
10 to 27 inches, brown to dark brown silty clay loam; friable to firm.
27 to 50 inches, dark yellowish-brown and brown silty clay loam to silt loam; friable to firm.

These soils absorb moisture somewhat slowly, have a poorly granulated surface layer, and are gently sloping to moderately steep. Consequently, they are susceptible to erosion. They are productive, however, if properly managed, and most of the acreage is cultivated. The less sloping soils are used for corn, oats, and hay; the steeper soils are used for pasture. The Ladoga soils are medium acid and are low or very low in available nitrogen, low or medium in phosphorus, and low or very low in potassium. The organic-matter content is also low.

Ladoga silt loam, 2 to 5 percent slopes (LaB).—This soil occurs at the crest of ridgetops and on slightly convex, narrow uplands divides. It has a very dark grayish-brown friable silt loam surface layer. Where it occurs on wide ridgetops or borders flat divides, the subsurface layer is more distinct than that of the typical Ladoga soil, and there are a few more mottles in the subsoil.

Erosion caused by runoff is a slight hazard in cultivated areas. If row crops are grown, this soil needs to be tilled on the contour. Row crops can be grown more frequently where fields are terraced. Growing grasses and legumes is beneficial if tilth becomes poor. Additions of organic matter are also beneficial. Yields of corn are favorable if management is good. Some areas of this soil are large enough to be farmed separately. *Capability unit IIe-1.*

Ladoga silt loam, 5 to 9 percent slopes (LaC).—This soil occurs mainly on convex side slopes and on very narrow rounded ridgetops and ridge crests. A few areas are on high benches. The surface layer is very dark gray to very dark brown silt loam and is about 6 inches thick. The subsurface layer is dark grayish-brown silt loam.

Cultivated areas are subject to erosion. Tilling on the contour, stripcropping on the contour, or terracing helps to conserve this soil if row crops are grown. Row crops can be grown more frequently where fields are terraced. Terraces are easily constructed on this soil. Development of seeded waterways is important in some places. Much of this soil is now used for permanent pasture or is wooded. These areas are well suited to cultivation, provided erosion is controlled. *Capability unit IIIe-1.*

Ladoga silt loam, 5 to 9 percent slopes, moderately eroded (LaC2).—This soil occurs on convex side slopes and to a lesser extent on loess benches. It has a 3- to 6-inch surface layer of very dark grayish-brown silt loam to silty clay loam. In most places the former lighter colored subsurface layer is mixed with the surface soil (fig. 14). A few severely eroded areas in which the surface layer is dark grayish brown to brown are included in the areas mapped.

Figure 14.—**Ladoga silt loam, 5 to 9 percent slopes, moderately eroded, on side slopes. Darker colored Ely soil in drainageways.**

Cultivated areas are readily eroded by runoff, and most areas are dissected by a few waterways. Consequently, if row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced. If terraced, it can be used more frequently for row crops. Additions of organic matter are beneficial. The shaping and seeding of waterways will help control further erosion. Yields of corn are moderate if management is good. Diversion terraces, constructed on the benches, help to protect soils downslope from runoff. *Capability unit IIIe-1.*

Ladoga silt loam, 9 to 14 percent slopes (LaD).—This soil occurs on moderately long, convex side slopes and to a lesser extent on loess benches. It has a 6-inch surface layer of very dark gray to very dark brown silt loam and a distinct lighter colored subsurface layer. In wooded areas, there generally is a thin layer of leaf litter on the surface, and the surface layer is from 4 to 8 inches thick and very dark gray.

This soil is readily eroded by runoff if vegetation is thin or lacking, and in many places it is dissected by waterways. Waterways can be shaped and seeded to prevent further erosion. If row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced. It is well suited to terraces and can be used more frequently for row crops if fields are terraced. Additions of organic matter are beneficial. Yields of corn are moderate if management is good. *Capability unit IIIe-3.*

Ladoga silt loam, 9 to 14 percent slopes, moderately eroded (LaD2).—This soil occurs on moderately long, convex side slopes and to a lesser extent on loess benches. It has a 3- to 6-inch surface layer of very dark grayish-brown silt loam or silty clay loam. In places the former lighter colored subsurface soil is mixed with the surface layer.

This soil has a somewhat poorly granulated surface layer and is readily eroded by runoff. Consequently, if row crops are grown, it needs to be tilled on the contour, stripcropped on the contour, or terraced. Because of the length and uniformity of the slopes, it is well suited to both stripcropping and terracing. Row crops can be grown more frequently in fields that are terraced. Yields of corn are moderate if management is good. If tilth is poor, grasses and legumes can be grown more frequently, or organic matter can be added. The shaping and seeding of waterways will help to prevent further erosion. *Capability unit IIIe-3.*

Ladoga silt loam, 14 to 18 percent slopes, moderately eroded (LaE2).—This soil occurs on long, convex slopes that are dissected by waterways. It has a 3- to 6-inch surface layer of silt loam to silty clay loam. In places the former lighter colored subsurface soil is mixed with the surface layer. The subsoil commonly is thinner than that of the less sloping Ladoga soils. One area in which the slope is as much as 20 percent was included in mapping. Also included are a few small areas of a less eroded soil that has a darker colored surface layer than this soil.

Runoff on this soil is rapid, and erosion is a serious hazard in areas where vegetation is thin or lacking. This soil is used principally for hay and pasture. A row crop can be grown for 1 year when stands are renovated. Yields of corn are moderately low, even if management is good. Stripcropping on the contour helps to reduce soil loss when row crops are grown. Gullies and waterways can be shaped and seeded to prevent their being further eroded. This soil provides suitable sites for ponds. *Capability unit IVe-1.*

Ladoga silt loam, benches, 2 to 5 percent slopes (LbB).—This soil occurs on high benches, adjacent to major streams in the county, but mainly along the English River. It is not subject to overflow by streams, but in places it receives runoff from soils upslope. A small acreage of a somewhat poorly drained soil is included in the areas mapped.

This soil is similar to the typical Ladoga soil, except that in many places a sandy substratum occurs at a depth of 48 to 60 inches. Diversion terraces, constructed on soils upslope, will help to protect this soil from runoff. This soil needs to be tilled on the contour if row crops are grown. If terraced, it can be used intensively for row crops. Additions of organic matter or the use of a rotation that includes grasses and legumes is beneficial in areas where tilth is poor. Yields of corn are favorable if management is good. *Capability unit IIe-1.*

Ladoga soils, 9 to 14 percent slopes, severely eroded (LdD3).—Except for one area, which is on a loess bench, these soils occur between waterways, on somewhat short convex knobs. They are so severely eroded that, in most places, the present surface layer consists of brown silty clay loam, or former subsoil. There are a few areas in which about 3 inches of the original surface layer of very dark grayish-brown silt loam to silty clay loam remains.

These soils are readily eroded by runoff. They have a moderately slow rate of water intake, are low in organic-matter content, and have poor tilth. If row crops are grown, fields need to be tilled on the contour, stripcropped on the contour, or terraced. The long slopes are suited to stripcropping. Terraces can be constructed in most places. Yields of corn are moderately low, even if management is good. Lime and fertilizer are needed to establish stands of grasses and legumes. Additions of organic matter are beneficial. *Capability unit IVe-4.*

Ladoga soils, 14 to 18 percent slopes, severely eroded (LdE3).—These soils occur on short convex knobs on ir-

regular side slopes, between waterways. They have been so severely eroded that, in most places, the present surface layer consists of brown silty clay loam, or former subsoil. There are a few areas in which about 3 inches or less of the original surface layer of very dark grayish-brown silt loam to silty clay loam remains. Included in the areas mapped are a few small areas in which the gradient is as much as 20 percent.

These soils have been eroded by runoff and are gullied in some places. The gullies can be shaped and seeded if diversion terraces are placed above these areas to intercept runoff. The best use for these soils is hay and pasture. Oats can be grown as a nurse crop when stands are renovated. Additions of organic matter and applications of lime and fertilizer will help to establish seedings. The carrying capacity of pastures is moderate, and control of grazing is important. *Capability unit VIe-1.*

Lamont Series

The Lamont series consists of soils that developed from loose, windblown sand that contained some silt and clay. The topography in most places is undulating to hilly, and runoff generally is moderate or rapid. The organic-matter content is low. The Lamont soils in Iowa County occur in such small areas and are so closely associated with the Chelsea and Fayette soils that they have been mapped as a complex with these soils. They are described under the heading "Chelsea Series."

Lawler Series

In the Lawler series are somewhat poorly drained, dark-colored soils that developed from water-deposited materials on nearly level second bottoms of the Iowa River and its tributaries and on uplands near Homestead. Fine-grained or medium-grained sand occurs at a depth of 30 to 45 inches. These soils are of minor extent in the county.

Representative profile:

- 0 to 17 inches, black to very dark brown loam; friable.
- 17 to 41 inches, very dark grayish-brown and dark grayish-brown loam; few olive-brown, yellowish-brown, and strong-brown mottles; friable.
- 41 to 75 inches, gray and yellowish-brown sand; loose.

Runoff is very slow on these soils, and internal drainage is moderate. The water table is often high, especially in spring. Consequently, tile drainage is needed in some areas, even though these soils are somewhat droughty during long dry periods because of their porous substratum. Most areas are above the flood plains, but some areas gradually merge with bottom lands and are subject to flooding during periods of extremely high water. The Lawler soils are acid unless limed within the past 5 years. They are low or medium in available nitrogen and low in phosphorus and potassium. They can be used intensively for row crops.

Lawler loam (Le).—This soil occurs on second bottoms that have a gradient of 1 percent or less. The surface layer is black to very dark brown loam and is 12 to 16 inches thick.

Plowing and planting generally are delayed on this soil because the water table is high in spring. Tile drains help to correct wetness if suitable outlets can be established. During long dry periods, this soil tends to be somewhat droughty. It can be used intensively for row crops, however, and, under good management, is highly productive of corn. Individual areas are small and commonly are farmed with adjoining somewhat better drained soils. *Capability unit I-1.*

Lawson Series

In the Lawson series are somewhat poorly drained, dark-colored soils that have formed from silty alluvium. These soils occur on nearly level to slightly undulating first bottoms that in some areas are dissected by meandering old channels.

Representative profile:

- 0 to 35 inches, black to very dark brown and very dark gray silt loam; friable.
- 35 to 68 inches, dark-gray, gray, and dark-brown silt loam; few strong-brown mottles; friable.
- 68 to 79 inches, gray and dark-brown sandy loam; very friable.

These soils vary both in thickness of the dark-colored soil and in depth to the stratified material. Some areas are subject to occasional flooding by meandering streams, but other areas are protected by dikes. These soils are fertile and are among the most productive bottom-land soils in the county. They are slightly acid but generally do not require lime. They are low or medium in available nitrogen and very low in phosphorus and potassium. The extent of their use is determined by the frequency of flooding.

Lawson silt loam (Lh).—This soil occurs on bottom lands that have a gradient of 1 percent or less. It is adjacent to old meandering channels. The dark-colored surface layer is 20 to 40 inches thick, and in places there are thin sandy layers in the subsoil. In a few small areas, about 6 inches of light-colored material has been deposited on the surface. Included in mapping are some soils that have a silty clay loam subsoil.

Occasionally, this soil is slightly wet because of overflow. The straightening of channels and the construction of dikes help to reduce overflow. Land leveling is beneficial in some areas. This soil responds to good management and can be used intensively for row crops. Yields of corn are better than average during years of average rainfall. Most of the acreage is cultivated, but a few areas are pastured or are sparsely wooded. The leveling of old channels will make these areas suitable for cultivation. *Capability unit I-2.*

Lindley Series

The Lindley series consists of moderately well drained, light-colored soils that formed from glacial till on highly dissected uplands. The slope ranges from 9 to 40 percent but is mostly between 18 and 25 percent. Because of the irregular dissected slopes, severely eroded spots and gullies are common in places.

Representative profile:

- 0 to 3 inches, very dark grayish-brown loam; friable.
- 3 to 8 inches, dark grayish-brown loam; friable.
- 8 to 25 inches, brown clay loam; firm.
- 25 to 47 inches, yellowish-brown clay loam; firm.

The Lindley soils are closely associated with the Keswick soils, and in many areas there is a narrow band of Keswick soil on the upper part of slopes. Nearly all of

the cleared areas have been cultivated at one time, but many of these areas have been allowed to revert to permanent vegetation because they were not productive. These soils erode readily if cultivated and generally are best suited to pasture or woods. They provide suitable sites for farm ponds. Thus, water for livestock can be provided. Wildlife habitats can be established around ponds. These soils commonly are very low in available nitrogen and phosphorus and low or very low in potassium. They are acid and need lime unless limed within the past 5 years.

Lindley loam, 9 to 14 percent slopes, moderately eroded (LnD2).—This soil occurs on irregular convex side slopes that are dissected by waterways. It is downslope from the Keswick, Clinton, and Ladoga soils. The surface layer consists of 3 to 6 inches of dark grayish-brown to very dark grayish-brown loam. Most of the former light-colored subsurface soil is mixed with the present surface layer. Included in the areas mapped are some small wooded areas in which the soils have a thin layer of leaf litter on the surface, a slightly darker colored surface layer than this soil, and a distinct subsurface layer that is 4 to 8 inches thick. Also included are a few less sloping soils.

This soil is low in organic-matter content and has poor tilth. It is readily eroded by runoff if the vegetation is thin or is lacking. The rate of water intake is moderately slow or slow. This soil is best suited to hay or pasture but can be used for row crops when pastures need renovating. Tilling on the contour or stripcropping on the contour helps to control erosion when row crops are grown. The carrying capacity of pastures is moderate, but yields of corn are low even if management is good. A diversion terrace, placed on this soil, helps to protect soils downslope from runoff. Gullies can be shaped and seeded. *Capability unit IVe-3.*

Lindley loam, 14 to 18 percent slopes, moderately eroded (LnE2).—This soil occurs on long, irregular, convex side slopes. It is dissected by many waterways and is gullied in some places. The surface layer is dark grayish-brown to very dark grayish-brown loam and is 3 to 6 inches thick. Included in the areas mapped are some small wooded areas in which the soils have a darker colored surface layer than this soil and a distinct light-colored subsurface layer.

Much of this soil has been cultivated but has been allowed to revert to pasture. In places there are a few trees. This soil is suited to pasture, woods, and wildlife habitats. Grazing needs to be controlled in pastures because the carrying capacity is low. Additions of lime and fertilizer are important when pastures are renovated. The removal of brush is necessary in some places. This soil provides suitable sites for the construction of ponds for the use of livestock. For the management of trees, refer to the section "Management of Woodland." *Capability unit VIe-3.*

Lindley loam, 18 to 25 percent slopes (LnF).—This soil occurs on long, strongly dissected side slopes that border river valleys. The surface layer consists of very dark gray loam and is about 3 inches thick. The subsurface layer is distinct, dark grayish-brown to grayish-brown loam and is from 4 to 8 inches thick. In some timbered areas, there is a thin layer of leaf litter on the surface.

This soil is suited to limited grazing, wildlife habitats, and trees. Most of the acreage is pastured or is wooded. The fencing of wooded areas will prevent trees being damaged by grazing. The numerous waterways and the shape and steepness of slopes make the renovation of pastures difficult. To help control erosion when pastures are renovated, part of the old vegetation can be maintained until new vegetation becomes established. Grazing needs to be controlled in pastures because the carrying capacity is low. The removal of brush is important in some areas. This soil provides suitable sites for farm ponds. Diversion terraces on this soil help to protect soils downslope from runoff. The section "Management of Woodland" gives some suggestions for the care of woodland. *Capability unit VIIe-1.*

Lindley loam, 18 to 25 percent slopes, moderately eroded (LnF2).—This is the principal Lindley soil in the county. It occurs on long, strongly dissected side slopes that border river valleys. Most areas are large. The surface layer of dark grayish-brown loam is 3 to 6 inches thick and, in most places, consists partly of former subsurface soil.

Although there are some scattered trees, particularly along waterways and fence rows, most of the acreage is used for permanent pasture. This soil is suited to limited grazing, woods, and wildlife habitats. Because of the steepness and shape of slopes, regular farm machinery cannot be used in places to renovate pastures. Therefore, the present grass vegetation should not be destroyed, although the removal of brush is necessary. The carrying capacity of pastures is very low. This soil provides suitable sites for ponds. The section "Management of Woodland" gives suggestions for the care of trees. *Capability unit VIIe-1.*

Lindley loam, 25 to 40 percent slopes (LnG).—This soil occurs on long, irregular, convex side slopes that border river valleys. It is dissected by many gullies and waterways. The thickness and color of the surface layer vary more than that of other Lindley soils. The surface layer commonly is about 6 inches of dark grayish-brown loam. The subsoil is thinner than that of less sloping Lindley soils. Included in the areas mapped are some severely eroded areas in which the surface layer is firm brown clay loam, and some uneroded soils that have a darker colored surface layer than this soil and a distinct subsurface layer.

Most of the acreage is wooded, but some is used for pasture. This soil is suited to very limited grazing, to woods, and to wildlife habitats. Slopes are too steep for the renovation of pastures with regular farm machinery, but brush can be removed. Control of grazing is necessary. The fencing of good wooded sites will prevent damage to trees by grazing. The section "Management of Woodland" gives suggestions for the care of trees. This soil provides suitable sites for the construction of ponds. *Capability unit VIIe-3.*

Lindley soils, 9 to 14 percent slopes, severely eroded (LsD3).—These soils occur on irregular, convex side slopes that are dissected by many gullies and waterways. Erosion has been so severe that in most places the present surface layer is firm brown clay loam, or former subsoil. The organic-matter content is low, and there are many rocks and pebbles on the surface. In some places about 3 inches or less of dark grayish-brown loam remains.

These soils are difficult to work. They puddle readily when wet and become deeply cracked when dry. Rainfall runs off rapidly because the rate of water intake is slow

and slopes are strong. These soils are suitable for pasture, woods, or wildlife habitats. The carrying capacity of pastures is low, however, and grazing needs to be controlled. Additions of organic matter, fertilizer, and lime are needed to establish pasture stands. Gullies can be shaped and seeded to prevent their being further eroded. A temporary terrace placed upslope will divert water from newly shaped waterways. The section "Management of Woodland" gives some suggestions for the care of trees. *Capability unit VIe-3.*

Lindley soils, 14 to 18 percent slopes, severely eroded (LsE3).—These soils occur on strongly dissected, irregular, convex side slopes. Erosion has been so severe that in most places the present surface layer consists of firm brown clay loam, or former subsoil. Many gullies have formed. In a few areas that are near waterways or at the base of slopes, the surface layer consists of a few inches of moderately dark colored loam.

These soils have only a thin vegetative cover, or they are barren. They are low in organic-matter content and are difficult to work. Some gullies will have to be filled and shaped before farm machinery can be used safely. Temporary diversion terraces will divert water from newly shaped waterways. These soils are suited to limited grazing, woods, and wildlife habitats. Grazing needs to be controlled because the carrying capacity of pastures is very low. Additions of organic matter, fertilizer, and lime are necessary when pastures are renovated. The section "Management of Woodland" gives some suggestions for the care of trees. *Capability unit VIIe-1.*

Lindley soils, 18 to 25 percent slopes, severely eroded (LsF3).—These soils occur on irregular, convex side slopes near the major rivers. Individual areas are large. Erosion has been so severe that in most places the present surface layer consists of firm brown clay loam, or former subsoil. Many gullies have formed. In a few areas that are at the base of slopes and near waterways, the surface layer is moderately dark colored loam.

These soils are very low in organic-matter content, have poor tilth, and have a moderately slow or slow rate of water intake. Most of the acreage is in permanent pasture, but many pastures are not productive. The best use for these soils is very limited grazing, woods, or wildlife habitats. Control of grazing is necessary in pastured areas. The renovation of pastures is difficult, but if grazing is limited, bluegrass will become reestablished. Wildlife plantings are suitable along gullies and waterways. Sites for ponds are available. The section "Management of Woodland" gives some suggestions for the care of trees. *Capability unit VIIe-1.*

Mahaska Series

The Mahaska series consists of somewhat poorly drained, dark-colored soils that developed from loess on nearly level upland divides. These soils are bordered by the gently sloping Otley soils.

Representative profile:

0 to 20 inches, black to very dark gray silty clay loam; friable to firm.
20 to 37 inches, very dark grayish-brown and dark grayish-brown silty clay loam; few or common yellowish-brown and strong-brown mottles; firm.
37 to 73 inches, gray and grayish-brown silty clay loam to silt loam; many yellowish-brown and strong-brown mottles; firm to friable.

The Mahaska soils are among the most productive soils in the county, and nearly all of the acreage is cultivated. Many areas have been drained by tile. Small areas, indicated on the map by a wet symbol, are drained by shallow surface ditches or by tile drains that have surface inlets. These soils are slightly acid. They are low or medium in available nitrogen, low or very low in phosphorus, and low in potassium. They respond to good management.

Mahaska silty clay loam (Ma).—This soil occurs on nearly level upland divides. The surface layer is friable to firm, black to very dark gray silty clay loam and is from 14 to 18 inches thick. Rainfall is readily absorbed by this soil, and little or no runoff occurs. Tile drains have been installed in most areas, but, nevertheless, field operations may be somewhat delayed in spring or in periods when rainfall is above average. Many areas of this soil are large enough to be farmed separately.

This soil can be used intensively for row crops but will puddle if it is worked when too wet. It is used mainly for corn and soybeans. Yields of corn are better than average if management is good. Crops respond well to fertilizer. *Capability unit I-1.*

Muscatine Series

The Muscatine series consists of somewhat poorly drained, dark-colored soils that formed from loess mainly on nearly level upland divides. A small area occurs on a loess-covered bench near Marengo.

Representative profile:

0 to 17 inches, black to very dark gray silty clay loam to silt loam; friable.
17 to 33 inches, dark grayish-brown silty clay loam; few or common yellowish-brown and strong-brown mottles; friable to firm.
33 to 60 inches, gray silty clay loam to silt loam; many yellowish-brown and strong-brown mottles; friable.

The Muscatine soils are among the most productive soils in the county, and most of the acreage is cultivated. Erosion is not a hazard. Consequently, if adequately fertilized, these soils can be used intensively for row crops and still remain productive. Tile drains are not essential in most areas, although field operations may be slightly delayed during wet periods. These soils absorb water at a moderate rate. They are medium acid and are low or medium in available nitrogen, low or very low in phosphorus, and low in potassium. The response to fertilization is good.

Muscatine silty clay loam (Mu).—This soil occurs principally on upland divides that have a gradient of 1 percent or less. A few areas are on loess benches. Small gently sloping areas that are dissected by poorly defined, shallow waterways were included in the areas mapped. Some runoff occurs in the gently sloping areas, but most of the rain that falls is absorbed. Consequently, this soil is slightly wet in spring. In places tile has been used to drain shallow waterways.

This soil can be used intensively for row crops. It is the most productive soil in the county and is used principally for corn and soybeans. Individual areas generally are large. Some areas are farmed with adjacent Tama soils. *Capability unit I-1.*

Nevin Series

In the Nevin series are somewhat poorly drained, dark-colored soils that formed from silty clay loam alluvium on nearly level low second bottoms along the major streams and their tributaries.

Representative profile:

0 to 20 inches, black to very dark grayish-brown silty clay loam; few olive-brown mottles; friable.
20 to 40 inches, olive-gray silty clay loam; common yellowish-brown and olive-brown mottles; firm.
40 to 60 inches, grayish-brown silty clay loam; common yellowish-brown and strong-brown mottles; firm.

The Nevin soils are among the most productive soils in the county. They can be used intensively for row crops. Tile drains are beneficial in wet years. Generally, favorable yields can be obtained without tile drainage, but farm operations may be slightly delayed during wet periods. Some areas receive runoff from soils upslope. Diversion terraces placed on these higher lying soils would reduce wetness on the Nevin soils and also prevent young crops from being damaged by silt.

Nevin silty clay loam (Nc).—This soil occurs on bottom lands that have a gradient of 1 percent or less. The surface layer of black to very dark gray silty clay loam is 15 to 20 inches thick. In places stratified silt and sand occur below a depth of 48 inches. Included in the areas mapped are some gently sloping Nevin soils. Also included are some Nevin soils that have about 16 to 18 inches of light-colored silty overwash on the surface.

This soil is slightly wet but generally does not require tile drainage. Most of the rain that falls is absorbed, but runoff from soils upslope collects in a few areas. Diversion terraces placed on these higher lying soils would divert water from this soil. If well managed, this soil can be used intensively for row crops. Most of the acreage is in corn and soybeans. Yields are better than average. *Capability unit I–1.*

Nodaway Series

The Nodaway series consists of moderately well-drained or somewhat poorly drained soils that developed from stratified light-colored and dark-colored alluvium. These soils occur on first bottoms, near the main channel of streams. Each flood deposits fresh sediments on the surface. In many places a dark-colored soil occurs below a depth of 36 inches.

Representative profile:

0 to 38 inches, stratified very dark gray and grayish-brown silt loam; few olive-brown mottles; friable.
38 to 63 inches, very dark gray and very dark grayish-brown silt loam; friable.

The danger of overflow is the principal limitation on these soils. The Nodaway soils can be used intensively for row crops and are productive if protected from overflow. In places, old meandering stream channels need to be leveled. These soils are slightly acid or neutral in reaction. They vary greatly in nutrients but commonly are low in available nitrogen, low or medium in available phosphorus, and low or very low in potassium. The response to management is good.

Nodaway silt loam (Nd).—This soil has a slope of 1 percent or less. It occurs as narrow strips that are parallel to streams. Most areas are dissected by at least one stream that cannot be crossed with farm machinery. This soil is likely to be flooded during periods of high rainfall, unless runoff is controlled by the straightening of stream channels and the construction of levees and drainage ditches. In places oxbows and depressions can be drained by ditches, or they can be leveled. Many areas of this soil are too small to be farmed separately.

If well managed, this soil can be used intensively for row crops. Yields of corn are better than average if overflow is controlled. Some wooded areas can be cleared and used for row crops. Areas that would be difficult to farm because of their small size can be left wooded or in permanent pasture. *Capability unit I–2.*

Nodaway silt loam, channeled (Nh).—This soil is similar to Nodaway silt loam, except that it is dissected by many old stream channels and bayous. Most channels cannot be crossed with farm machinery, and some are filled with water at least part of the year. The slope is 1 percent or less.

This soil is subject to frequent flooding. A few areas are cropped, but most of the acreage is used for permanent pasture or woods. Generally, it is not practical to use this soil for crops because trees must be removed, channels straightened or filled, and dikes built or drainage ditches dug. Yields of row crops vary greatly unless overflow is controlled. If trees and shrubs are removed, the carrying capacity of pastures is high. *Capability unit Vw–1.*

Nodaway silt loam, silty clay loam substratum (Ns).—This soil occurs as narrow bands that are adjacent to stream channels. It is similar to Nodaway silt loam, except that it is underlain at a depth of 20 to 36 inches by dark-colored silty clay loam, which is a buried soil (fig. 15). The depth to the water table varies. Individual areas are too small to be farmed separately.

This soil is occasionally flooded, and the buried soil has a moderately slow rate of water intake. Consequently, wetness is the principal limitation. Tile drains are needed in most places. If drained, this soil can be used intensively for row crops. In undrained areas, field operations may be delayed during wet periods. Yields of corn are favorable if management is good. *Capability unit IIw–2.*

Nodaway-Ely complex (Nx).—This complex formed from material washed from surrounding uplands. It occurs in all parts of the county, but mainly along small drainageways in soil associations 6 and 7. The slope ranges from 2 to 5 percent. The soils of this complex are described in detail under their respective series.

This complex occurs in small areas that are dissected by one or more gullies or waterways. During normal or heavy rains, the waterways are filled with water and, unless protected, will develop into gullies. In some places, waterways can be shaped and seeded to help prevent erosion. In others, structures are needed in addition to the shaping and seeding of waterways. Erosion control structures and ponds have been built in some areas.

This complex is well suited to row crops, but most areas are small and, consequently, are farmed with adjoining higher soils. Those areas that are adjacent to steep pastured land are left in pasture; those that are next to cultivated fields are used for crops. Yields of corn are better than average if management is good. *Capability unit IIw–1.*

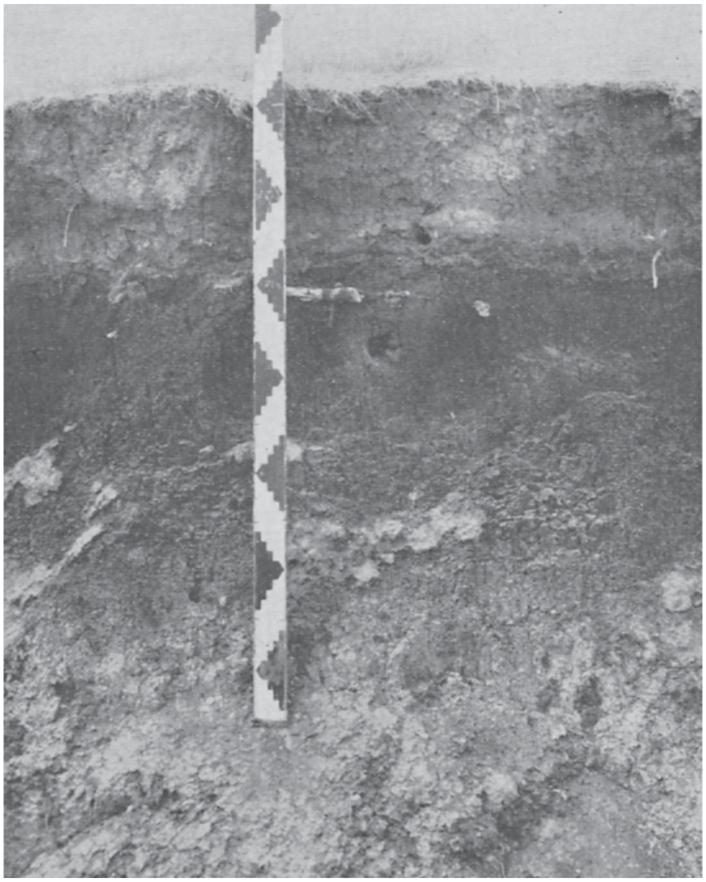

Figure 15.—**Profile of Nodaway silt loam, silty clay loam substratum. About 30 inches of lighter colored soil material has buried the original black soil.**

Otley Series

The Otley series consists of moderately well drained, dark-colored soils derived from loess. These soils occur predominantly on ridgetops, crests, and side slopes, in the southern two-thirds of the county. A few areas are on loess-covered benches along the English Rivers and their tributaries. The Otley soils are extensive in the county. They have a slope range of 2 to 18 percent (fig. 16).

Representative profile:

0 to 13 inches, black to very dark gray and very dark brown silty clay loam; friable.

13 to 42 inches, very dark grayish-brown, dark-brown, and brown silty clay loam; few yellowish-brown and strong-brown mottles; friable to firm.

42 to 68 inches, yellowish-brown silty clay loam to silt loam; many grayish-brown and strong-brown mottles; friable to firm.

Permeability is moderately slow on these soils, and runoff is rapid on the steeper soils. Thus, control of erosion is a major problem if row crops are grown. In places a narrow seepy band occurs where these soils are adjacent to lower lying soils derived from glacial till.

The Otley soils have long, smooth, convex slopes. In most places, they can be tilled on the contour, stripcropped on the contour, or terraced. They are acid unless limed and are very low to medium in available nitrogen, very low in phosphorus, and low or very low in potassium. The uneroded soils are high in organic-matter content. The gently sloping Otley soils are among the most productive soils in the county.

Otley silty clay loam, 2 to 5 percent slopes (OcB).—This soil occurs on ridge crests, adjacent to the Mahaska soils, and on narrow convex ridgetops. The surface layer is black to very dark brown friable silty clay loam and is from 12 to 14 inches thick.

This soil is high in organic-matter content and has good tilth. It is readily eroded by runoff when crops are small or when the surface is barren. It needs to be tilled on the contour if row crops are grown, and it can be used intensively for row crops if fields are terraced. Although drainageways are narrow enough to be crossed with farm machinery, they may be wet in places. Tile can be used to drain these areas. Yields of corn are above average if management is good. *Capability unit IIe-1.*

Otley silty clay loam, 5 to 9 percent slopes (OcC).—This soil occurs on ridge crests and convex side slopes that are dissected in places by a few shallow drainageways. The surface layer is black to very dark brown silty clay loam and is from 10 to 14 inches thick.

Figure 16.—**Typical profile of Otley silty clay loam, the dominant soil type in Iowa County.**

Cultivated fields are readily eroded. Thus, if row crops are grown, tillage needs to be done on the contour. Corn can be grown more frequently if fields are terraced. The somewhat smooth, convex slopes generally are suited to terracing. The shaping and seeding of waterways will help to control erosion. This soil is benefited by additions of nitrogen and phosphate. If management is good, yields of corn are above average. *Capability unit IIIe–1.*

Otley silty clay loam, 5 to 9 percent slopes, moderately eroded (OcC2).—This soil occupies entire convex side slopes and in many places bands the shoulder of side slopes. It has a 3- to 6-inch surface layer of very dark brown to dark grayish-brown silty clay loam. Included in the areas mapped are small areas near waterways, where the surface layer is thicker and darker colored than that of this soil.

This soil is moderately high in organic-matter content and has goood tilth. Runoff is moderately rapid, however, and erosion is a serious hazard. If row crops are grown, tillage needs to be done on the contour. If fields are terraced, row crops can be grown more frequently. Most slopes are smooth and are suited to terracing. Crops respond to fertilization. Yields of corn are above average if management is good. *Capability unit IIIe–1.*

Otley silty clay loam, 9 to 14 percent slopes, moderately eroded (OcD2).—This soil occupies smooth convex side slopes but, in many places, grades to lower lying soils that formed from glacial till. It has a 3- to 6-inch surface layer of very dark brown to very dark grayish-brown silty clay loam. A few Otley soils that have a darker colored, thicker surface layer are included in the areas mapped.

Runoff is rapid on this soil, and erosion control practices are needed. If row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced. If terraced, it can be used more frequently for row crops. The shaping and seeding of gullies will also help to prevent soil loss. Although this soil commonly has good tilth, additions of organic matter are beneficial. Crops respond to applications of nitrogen and phosphate. Yields of corn are favorable if management is good. *Capability unit IIIe–3.*

Otley silty clay loam, 9 to 14 percent slopes, severely eroded (OcD3).—This soil occurs on short convex side slopes that commonly are dissected by small gullies and waterways. It is so severely eroded that in most places it has a dark-brown to brown surface layer that is low in organic-matter content. In a few places about 3 inches of the original very dark grayish-brown surface layer remains.

This soil has poor tilth, puddles easily if worked when wet, and becomes hard and cloddy when dry. Individual areas are small and generally are farmed with adjacent, less eroded soils. This soil can be used occasionally for row crops if it is tilled on the contour or stripcropped on the contour. Terraces are difficult to construct in many areas because of the numerous waterways and the shape of the slopes. Additions of organic matter, lime, and fertilizer are needed. Yields of corn are moderate if management is good. *Capability unit IVe–4.*

Otley silty clay loam, 14 to 18 percent slopes, moderately eroded (OcE2).—This soil occurs as bands on the shoulder of side slopes and, in some places, occupies entire convex side slopes. It has a 3- to 6-inch surface layer of very dark brown to very dark grayish-brown silty clay loam. The subsoil is thinner than that of less sloping Otley soils. Included in the areas mapped are a few severely eroded areas of Otley soils that have a dark-brown to brown surface layer.

Runoff is very rapid on this soil, and consequently erosion is a serious hazard in cultivated areas. This soil can be used occasionally for row crops if it is stripcropped on the contour. Terraces generally are not suitable. Yields of corn are moderately low, even if management is good. Lime and phosphate are needed when alfalfa is grown. *Capability unit IVe–1.*

Otley silty clay loam, benches, 2 to 5 percent slopes (OtB).—This soil occurs on gently sloping benches. The surface layer is black to very dark brown, friable silty clay loam and is from 12 to 14 inches thick. Included in the areas mapped are a few soils on the shorter, steeper slopes that border the benches. Some of these included soils are moderately eroded and have a thinner surface layer than this soil.

In most places this soil has moderate runoff. However, diversion terraces are needed in places to intercept runoff from higher adjacent soils. This soil needs to be tilled on the contour if row crops are grown. It can be used intensively for row crops if fields are terraced. The spacing for terraces, however, would vary because of the shape of the slopes. Yields of corn are above average if management is good. *Capability unit IIe–1.*

Shelby Series

The Shelby series consists of moderately well drained, dark-colored soils that developed from clay loam glacial till on irregular convex slopes. These soils occur throughout the county, except in the area north of the Iowa River. They are downslope from the Adair soils and upslope from the Colo and Ely soils, which are in waterways. The slope ranges from 5 to 25 percent.

Representative profile:

0 to 12 inches, very dark grayish-brown and dark-brown loam; friable.
12 to 35 inches, dark yellowish-brown clay loam; firm.
35 to 45 inches, yellowish-brown loam; few strong-brown mottles; firm.

The Shelby soils are subject to severe erosion if cultivated. They are acid unless limed and generally are low or very low in available nitrogen and potassium and very low in phosphorus. The strongly sloping and steep areas are used mainly for pasture. The less sloping areas are used for row crops. Corn, small grain, and hay are the principal crops. Small areas of Adair soils, which occur as narrow bands on the upper part of slopes, are included in the areas mapped. These areas are wet and seepy in spring or during periods of high rainfall.

Shelby loam, 5 to 9 percent slopes (ShC).—This soil occurs mainly on narrow ridgetops that are at a lower elevation than the surrounding divides. Some areas are on side slopes. The surface layer of very dark gray loam is from 12 to 14 inches thick. A few less sloping Shelby soils are included in the areas mapped.

This soil has good tilth and is easy to work. It is readily eroded, however, because of the moderately slow rate of water intake and the strong slopes. Many areas are too small to be farmed separately. Row crops can be grown without excessive soil loss if fields are tilled on the contour

or terraced. Terraces are difficult to construct because of the shape and length of the slopes. Yields of corn are moderate if management is good. *Capability unit IIIe–1.*

Shelby loam, 5 to 9 percent slopes, moderately eroded (ShC2).—This soil occurs on narrow ridgetops and convex side slopes that are dissected by some waterways. The surface layer of very dark grayish-brown loam is 3 to 6 inches thick. Some severely eroded areas in which the surface layer is brown clay loam are included in the areas mapped. These areas are indicated on the soil map by a severe erosion symbol.

Runoff is moderately rapid on this soil. Consequently, if row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced to help control erosion. Terraces are difficult to construct in some areas. Tilth is poor in places, and additions of organic matter are beneficial. Legumes need lime and phosphate. Yields of corn are moderate if management is good. *Capability unit IIIe–1.*

Shelby loam, 9 to 14 percent slopes, moderately eroded (ShD2).—This is the major Shelby soil in the county. It occurs on irregular, convex side slopes that commonly are dissected by waterways and some gullies. The surface layer of very dark grayish-brown loam is from 3 to 6 inches thick. A few areas that are in permanent pasture are included in the areas mapped. In these areas the surface layer is thicker and darker colored than that of this soil.

Runoff on this soil is rapid, and erosion is a serious hazard. The rate of water intake is moderately slow. If row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced to prevent excessive soil loss. Row crops can be grown more frequently if fields are terraced. In some places terraces are difficult to construct because of the shape and length of the slope and presence of waterways. This soil has poor tilth in places and is benefited by additions of organic matter. Legumes need lime and phosphate. Yields of corn are moderately low even if management is good. *Capability unit IIIe–3.*

Shelby loam, 14 to 18 percent slopes, moderately eroded (ShE2).—This soil occurs on long, irregular, convex slopes that are dissected by gullies and waterways. Most areas are large. The surface layer of very dark grayish-brown loam is from 3 to 6 inches thick. In places lime occurs at a depth of 36 inches or more. A few uneroded Shelby soils are included in the areas mapped.

Erosion is a serious hazard on this soil because slopes are moderately steep and the rate of water intake is moderately slow. This soil is best suited to hay or pasture. A row crop can be grown when stands are renovated, if fields are stripcropped on the contour. The carrying capacity of pastures is moderate, but additions of lime and fertilizer are needed for maximum production. Diversion terraces, constructed on this soil, will protect soils downslope from runoff. This soil provides suitable sites for ponds. *Capability unit IVe–1.*

Shelby loam, 18 to 25 percent slopes, moderately eroded (ShF2).—This soil occurs on short, irregular, convex side slopes that are dissected by waterways and gullies. The surface layer of very dark grayish-brown loam is 3 to 6 inches thick. Some severely eroded areas of more steeply sloping Shelby soils are included in the areas mapped. These areas are indicated on the soil map by erosion symbols.

Runoff is very rapid on this soil. The surface layer has poor tilth and generally is cloddy and hard when dry. Seedbeds are difficult to prepare. This soil is best suited to permanent pasture, woods, and wildlife habitats. Although the carrying capacity of pastures is moderate, control of grazing is necessary. Removal of shrubs will improve pastures. Gullies and waterways can be shaped and seeded. Diversion terraces, placed on this soil, will protect soils downslope from runoff. This soil provides suitable sites for ponds. The section "Management of Woodland" gives some suggestions for the care of woodland. *Capability unit VIe–2.*

Shelby soils, 9 to 14 percent slopes, severely eroded (SoD3).—These soils occur on short abrupt convex side slopes, between gullies and waterways. They have been so severely eroded that, in most places, the surface layer consists of dark-brown to dark yellowish-brown clay loam, or former subsoil. In a few places about 3 inches or less of the original loam surface layer remains. Individual areas of these soils are too small to be farmed separately.

These soils are very low in organic-matter content and have poor tilth. They puddle easily if worked when wet, and they become hard and cloddy when dry. Runoff is rapid. Row crops can be grown occasionally if fields are stripcropped on the contour. A row crop generally is grown when hay or pasture stands are renovated. Yields of corn are low even if management is good. Legumes need both lime and phosphate. Terraces are difficult to construct on these soils because of the shape and length of the slopes. *Capability unit IVe–4.*

Shelby soils, 14 to 18 percent slopes, severely eroded (SoE3).—These soils occur on irregular convex side slopes that are dissected by gullies and waterways. They have been so severely eroded that the surface layer consists of dark-brown to yellowish-brown clay loam, or former subsoil. In a few areas, near waterways and at the base of slopes, the surface layer is loam, and it is darker colored than that of these soils.

These soils are very low in organic-matter content, have poor tilth, and become cloddy and hard when dry. If the vegetation is thin or is destroyed, gullies will enlarge or others will form. The shaping and seeding of gullies will prevent their becoming further eroded. These soils are suited to hay and pasture, but stands may be difficult to establish unless organic matter, fertilizer, and lime are added. Although the carrying capacity of pastures is moderate, grazing needs to be controlled. Ponds can be constructed to provide water for livestock. Diversions constructed on these soils will protect soils downslope from runoff. *Capability unit VIe–1.*

Sperry Series

The Sperry series consists of very poorly drained, dark-colored soils that have a distinct light-colored subsurface layer. These soils formed from loess in slightly depressed areas, on broad upland divides. Individual areas are from 1 to 2 acres in size.

Representative profile:

0 to 7 inches, black to very dark gray silt loam; friable.

7 to 19 inches, dark-gray and gray silt loam; few olive-brown and yellowish-brown mottles; very friable.

19 to 38 inches, dark gray heavy silty clay loam; common yellowish-brown and brown mottles; firm.
38 to 60 inches, gray silty clay loam; few yellowish-brown and strong-brown mottles; friable to firm.

The Sperry soils are surrounded by the slightly higher lying Mahaska and Taintor soils, and they receive runoff that originates on these soils. Shallow drainage ditches are needed to remove surface water. If drained, the Sperry soils are suited to row crops. They are slightly acid and are low in available nitrogen, very low in phosphorus, and low or very low in potassium.

Sperry silt loam (Sp).—This soil occurs in slight depressions on ridgetops that have a gradient of less than 1 percent. It has a black silt loam surface layer that is from 6 to 10 inches thick; a distinct, gray subsurface layer that is about 10 inches thick; and a firm, grayish subsoil that absorbs water slowly or very slowly. In most places, surface drains are needed to remove ponded water. Tile drains do not function well.

The individual areas of this soil are small and generally are farmed with adjoining soils. Field operations are often delayed because this soil dries out slowly. In wet years, crops are stunted and turn yellow, and in some years alfalfa is winterkilled. Row crops can be grown frequently, however, if wetness is reduced. Yields of corn are moderate, provided management is good. *Capability unit IIIw-2.*

Stronghurst Series

In the Stronghurst series are somewhat poorly drained, light-colored soils that developed from loess. These soils occur on nearly level upland divides and on loess-covered benches.

Representative profile:

0 to 8 inches, dark-gray silt loam; friable.
8 to 13 inches, grayish-brown silt loam; few olive-brown and yellowish-brown mottles; very friable.
13 to 49 inches, grayish-brown silty clay loam; common yellowish-brown, olive, and strong-brown mottles; friable to firm.
49 to 57 inches, grayish-brown silt loam; many yellowish-brown and strong-brown mottles; friable.

Farm operations are often delayed on these soils in spring and during wet periods. Tile has been used to drain some areas. These soils are low in organic-matter content and are strongly acid. They are very low in available nitrogen, low or medium in phosphorus, and very low in potassium.

Stronghurst silt loam (Sr).—This soil occurs on nearly level, somewhat broad upland divides. In undisturbed areas, the surface layer is very dark gray silt loam and is from 3 to 6 inches thick. In cultivated areas, the former light-colored subsurface layer is mixed with the surface soil. The largest area of this soil is in sections 5, 6, 7, and 8, of Washington Township. Included in the areas mapped are some soils that occur in depressions. These areas are wet and are indicated on the soil map by a wet symbol.

Erosion is not a hazard on this soil, but wetness caused by a moderately high water table may delay farm operations in spring or during wet periods. This soil can be used frequently for row crops but needs additions of organic matter, lime, and fertilizer. If well managed it is productive of corn. The response to fertilizer is good. *Capability unit IIw-4.*

Stronghurst silt loam, benches (St).—A profile of this soil is similar to the one described as typical of the series. This soil occurs on nearly level loess-covered benches that are high above the flood plains. Although it is not subject to overflow, in places it receives runoff that originates on surrounding uplands. Rain that falls on the surface is absorbed, but runoff from higher areas may pond in places. Thus, in wet periods farm operations may be delayed. In many areas a diversion terrace placed at the base of upland slopes will divert water from this soil. Tile can be used to drain small wet areas.

This soil is well suited to row crops but needs applications of nitrogen and phosphate if corn is grown frequently. Additions of organic matter are also beneficial. The response to fertilization is good. Yields of corn and other row crops are favorable. *Capability unit IIw-4.*

Taintor Series

The Taintor series consists of poorly drained, dark-colored soils that developed from loess. These soils occur in level to slightly depressed areas on broad upland divides. The Taintor soils for the most part are surrounded by Mahaska soil. Two small areas near Homestead are adjacent to the Muscatine soils.

Representative profile:

0 to 20 inches, black to very dark gray silty clay loam; friable to firm.
20 to 36 inches, very dark gray to dark-gray silty clay loam to silty clay; a few dark yellowish-brown and yellowish-brown mottles; firm.
36 to 65 inches, gray and olive-gray silty clay loam; common yellowish-brown mottles; friable or firm.

Natural drainage is poor on these soils, and tile has been used to drain most areas. A few small wet areas can be improved by the use of shallow surface ditches or tile drains that have a surface inlet. These areas are indicated on the soil map by a wet symbol. If drained, the Taintor soils are highly productive and can be used intensively for corn and soybeans. They are slightly acid in most places but range to medium acid unless limed. They are low or medium in available nitrogen, very low in phosphorus, and low or very low in potassium. The response to fertilizer is good.

Taintor silty clay loam (Ta).—This soil is on nearly level to slightly depressed upland divides. The surface layer of black silty clay loam is 15 to 20 inches thick and is high in organic-matter content. Included in the areas mapped are a few areas in which the subsoil is medium silty clay loam instead of heavy silty clay loam. These areas are associated with the Muscatine and Tama soils.

Rainfall does not run off this soil, and the rate of water intake is moderately slow or slow. The water table is high during part of the year. This soil is difficult to till and puddles easily if worked when wet. Plowing is often done in fall so that clods will be broken by freezing and thawing. If this soil is drained by properly spaced tile, it can be used intensively for row crops. Yields of corn are above average if management is good. *Capability unit IIw-3.*

Tama Series

The Tama series consists of well-drained, dark-colored soils that formed from loess mainly on convex ridgetops, ridge crests, and side slopes, on the uplands. A few areas are on loess-covered benches. The slope ranges from 2 to 18 percent but is mainly between 5 and 9 percent.

Representative profile:

0 to 15 inches, black to very dark brown and very dark grayish-brown silty clay loam; friable.

15 to 43 inches, dark-brown to brown silty clay loam; friable to firm.

43 to 67 inches, brown and yellowish-brown silt loam; few yellowish-brown and light grayish-brown mottles; friable.

The uneroded Tama soils are high in organic-matter content, have good tilth, and are easy to work. They absorb water at a moderate rate but are readily eroded by runoff. The less sloping soils are well suited to row crops and in most places are productive. The Tama soils are medium acid. They are low or medium in available nitrogen and low or very low in phosphorus and potassium. The response to fertilizer is good. Most of the acreage is cultivated.

Tama silty clay loam, 2 to 5 percent slopes (TcB).—A profile of this soil is similar to the one described as typical of the series. This soil occupies both gentle convex ridge crests on broad upland divides and moderately wide ridgetops in association with the Tama, Downs, and Shelby soils.

This is one of the most productive soils in the county. It is slightly susceptible to erosion, however, and needs to be tilled on the contour if row crops are grown. It can be used intensively for row crops if it is terraced. The smooth, convex slopes are suited to terracing. Yields of corn are considerably above average if management is good. Some individual areas of this soil are large enough to be farmed separately. *Capability unit IIe–1.*

Tama silty clay loam, 5 to 9 percent slopes (TcC).—This soil occurs on smooth, convex side slopes and on extended narrow ridgetops. It has an 8- to 15-inch surface layer of black or very dark brown silty clay loam to silt loam. Some of the acreage has been used for pasture.

This soil is friable and easy to work, but it is readily eroded if the vegetation is thin or the surface is barren. It needs to be tilled on the contour or terraced if row crops are grown. Row crops can be grown frequently if fields are terraced. This soil is well suited to terracing because of the shape of its slopes and the favorable texture of the subsoil. Yields of corn are above average, provided management is good. *Capability unit IIIe–1.*

Tama silty clay loam, 5 to 9 percent slopes, moderately eroded (TcC2).—This is one of the major Tama soils in the county. It occurs on smooth, convex side slopes and is dissected by a few shallow waterways. The surface layer of very dark brown to very dark grayish-brown silty clay loam is from 3 to 6 inches thick. A few Tama soils that have less than 3 inches of the original surface layer remaining are included in the areas mapped.

Runoff is rapid on this soil because of the slope, and erosion is a serious hazard. If row crops are grown, tillage needs to be done on the contour. Row crops can be grown frequently without excessive soil loss if fields are terraced. This soil is well suited to terracing because of the shape of its slopes and the favorable texture of the subsoil. Yields of corn are favorable, provided management is good. Some individual areas of this soil are large enough to be farmed separately. *Capability unit IIIe–1.*

Tama silty clay loam, 9 to 14 percent slopes, moderately eroded (TcD2).—This is one of the major Tama soils in the county. It occurs on moderately long, smooth, convex side slopes and is dissected by a few waterways. The surface layer consists of 3 to 6 inches of very dark brown to very dark grayish-brown silty clay loam to silt loam. In places, at the shoulder of side slopes, the surface layer is only 3 inches thick. Included in the areas mapped are some Tama soils on short, convex side slopes of benches.

This soil has rapid runoff. If used for row crops, it needs to be tilled on the contour, stripcropped on the contour, or terraced to prevent excessive soil loss. Both stripcropping and terracing are suitable because of the length and smoothness of the slopes. Yields of corn are favorable if management is good. Some areas of this soil are large enough to be farmed separately. *Capability unit IIIe–3.*

Tama silty clay loam, 9 to 14 percent slopes, severely eroded (TcD3).—This soil occurs mainly on short rounded side slopes, between gullies and waterways. Some areas are on the shoulder of side slopes. All of the original dark-colored surface layer has been removed by sheet erosion, and the present surface layer consists mainly of dark-brown silty clay loam. At the base of slopes and near waterways are some areas in which the surface layer is darker colored and thicker than that of this soil.

This soil is low in organic-matter content and commonly becomes cloddy and moderately hard when dry. The surface may seal when wet. Runoff is rapid, and some gullies have formed. If row crops are grown, fields need to be tilled on the contour, stripcropped on the contour, or terraced to prevent excessive soil loss. The construction of terraces may be difficult in places because of the shape and length of the slope. This soil occurs mainly in small areas and commonly is farmed with less eroded Tama soils. These areas are best left in meadow an additional year when surrounding soils are cultivated. Additions of organic matter are beneficial. Yields of corn are moderate if management is good. *Capability unit IVe–4.*

Tama silty clay loam, 14 to 18 percent slopes, moderately eroded (TcE2).—This soil occurs on moderately long, convex slopes and is dissected by a few waterways. In most places the surface layer is 3 to 6 inches of very dark brown to very dark grayish-brown silty clay loam. Included in the areas mapped are a few small areas of Tama soils that have an 8- to 15-inch, dark-colored surface layer. Many of these areas are in pasture. Also included are a few severely eroded areas in which the dark-brown to brown subsoil is exposed.

This soil has rapid runoff and will erode readily if the surface is barren or the vegetation is thin. It can be used occasionally for row crops if it is stripcropped on the contour. Terracing generally is not practical because of the steepness and shape of the slopes. Eroded areas are benefited by additions of organic matter. Lime and phosphate are needed if legumes are grown. Yields of corn are moderate if management is good. Most individual areas are small and are used in the same way as the surrounding soils. *Capability unit IVe–1.*

Tama silty clay loam, benches, 0 to 2 percent slopes (ThA).—This soil occurs on loess-covered benches that are above flood plains. Most of the acreage is on a bench near

Marengo. The surface layer is black to very dark brown friable silty clay loam and is from 12 to 14 inches thick. In places sand strata occur at a depth of 45 inches or more.

This soil is too high above flood plains to be flooded by rivers or streams, but it receives some runoff that originates on soils upslope. Diversion terraces placed on higher lying soils will help to divert water from this soil. This soil has a moderate rate of water intake and absorbs most of the rain that falls. In years of below normal rainfall, droughtiness may be a more serious hazard on this soil than on level or nearly level Tama soils on uplands. This soil is highly productive and, if well managed, can be used intensively for row crops. Yields are considerably above average if fertilizer is applied. *Capability unit I–1.*

Tama silty clay loam, benches, 2 to 5 percent slopes (ThB).—This soil occurs on gently rolling, loess-covered benches near Marengo. It is the major Tama soil on benches. The surface layer of black to very dark brown, friable silty clay loam is from 12 to 14 inches thick. Although sand layers occur below a depth of 45 inches in some places, this soil is not droughty, except in years of below average rainfall. Sheet erosion is a slight hazard because runoff is moderate. A few Tama soils on short, steeper side slopes of benches are included in the areas mapped.

This soil is suited to row crops, but it needs to be tilled on the contour or terraced to control erosion. It can be used more frequently for row crops if fields are terraced. However, some areas may be difficult to terrace because of the length of the slope. Diversion terraces can be used to prevent overflow from soils upslope. Some areas of this soil are large enough to be farmed separately; others are farmed with surrounding soils. Yields of corn are above average if management is good. *Capability unit IIe–1.*

Tell Series

The Tell series consists of well-drained or somewhat excessively drained, moderately dark colored to light-colored soils that developed from 24 to 40 inches of highly silty sediments over fine and medium sand. The slope ranges from 2 to 14 percent but is mostly between 5 and 9 percent. These soils occur in small areas, on intermediate uplands near the junction of State Highway 149 and U.S. Highway 6, and eastward to the county line. They extend from 1 to 2 miles south of U.S. Highway 6. A few scattered areas are along Price Creek in Lenox Township.

Representative profile:

0 to 6 inches, very dark gray silt loam; friable.

6 to 10 inches, dark-gray to dark grayish-brown silt loam; friable.

10 to 28 inches, brown to dark-brown silt loam to silty clay loam; few strong-brown and gray mottles; friable.

28 to 72 inches, yellowish-brown loam that grades to brownish-yellow and yellow sand; loose.

The Tell soils are droughty at times, particularly in areas where sand occurs at a depth of about 24 inches. They are low in organic-matter content and have moderate or low moisture-holding capacity. They are strongly acid and generally are low or very low in available nitrogen, low or medium in phosphorus, and low or very low in potassium. Moderate yields can be obtained if rainfall is adequate and timely throughout the growing season. Most of the acreage is used for crops.

Tell silt loam, 2 to 5 percent slopes (TmB).—This soil occurs in slightly rounded high areas and on ridges, on the uplands. In wooded areas there commonly is a 1-inch layer of leaf litter on the surface. In cultivated areas, the surface layer is dark grayish-brown to very dark grayish-brown silt loam. Sand generally occurs at a depth of 30 to 40 inches.

In most years, this soil is slightly droughty. It commonly does not hold sufficient moisture to prevent damage to crops from drought during July and August. Yields depend largely on the amount of rainfall but are greatly increased if rains are timely. This soil commonly is farmed with adjacent, less droughty soils. It is readily eroded by runoff and, if used for row crops, needs to be tilled on the contour. If terraced, it can be used more frequently for row crops. Cuts for terraces should be shallow. The response to management is good or fair. *Capability unit IIs–1.*

Tell silt loam, 5 to 9 percent slopes (TmC).—This soil occurs on convex side slopes and narrow ridges. Much of the acreage is in pasture or is wooded. In wooded areas there generally is some leaf litter on the surface. This soil has a very dark gray surface layer and a distinct gray to dark grayish-brown subsurface layer. The depth to sand averages about 30 inches.

Droughtiness is a moderate hazard on this soil. In most years crops show a need for moisture during July and August. Yields depend largely on the timeliness of rainfall. If row crops are grown, this soil needs to be tilled on the contour to prevent excessive soil loss. Row crops can be grown more frequently if fields are terraced. The depth of cuts and the amount of fill should be limited where terraces are constructed so as not to expose the sandy substratum. The response to management is fair or good. *Capability unit IIIs–2.*

Tell silt loam, 5 to 9 percent slopes, moderately eroded (TmC2).—This soil occurs on rounded side slopes and on ridges. Some slopes are short and are irregularly shaped. The surface layer generally consists of 3 to 6 inches of dark grayish-brown to very dark grayish-brown silt loam to silty clay loam. In places the former subsurface layer is mixed with the surface soil, and the present surface layer is gray to dark grayish brown. In most areas sand occurs at a depth of 24 to 30 inches.

This soil is somewhat droughty, and crops generally are affected by lack of moisture during summer months. If rains are timely, yields are moderate. This soil is subject to erosion and needs to be tilled on the contour when row crops are grown. It can be used more frequently for row crops if fields are terraced. The construction of terraces may not be feasible in areas where slopes are irregular. If terraces are constructed, the depth of cuts and the amount of fill should be limited. This soil is low in organic-matter content and benefits from additions of fertilizer. The response to management is fair. *Capability unit IIIs–2.*

Tell silt loam, 9 to 14 percent slopes, moderately eroded (TmD2).—This soil occurs on convex side slopes, some of which are short and irregular. It has a 3- to 6-inch surface layer of dark grayish-brown silt loam to silty clay loam. In places the former subsurface layer is mixed with the surface soil, and the present surface

layer is gray to dark grayish brown. In most places sand occurs at a depth of 24 to 30 inches. Included in the areas mapped are a few areas in which less than 3 inches of the original surface layer remains and the brown subsoil is exposed.

This soil has low moisture-holding capacity. It generally is slightly more droughty than the less eroded and less sloping Tell soils. Even in years of normal rainfall, yields vary and ordinarily are low. This soil is better suited to hay and pasture than to row crops, but it is often farmed with surrounding soils. If row crops are grown, tillage needs to be done on the contour. Row crops can be grown more frequently if fields are terraced. Some areas may be difficult to terrace or to stripcrop because of the length and shape of the slopes. If terraces are constructed, the depth of cuts and the amount of fill should be limited so as not to expose the sandy substratum. This soil responds only fairly well to management. *Capability unit IVe–5.*

Udolpho Series

The Udolpho series consists of somewhat poorly drained soils that developed from medium-textured material and are underlain at a depth of 30 to 50 inches by fine and coarse sand. These soils have distinct, light-colored subsurface layers. Most of the acreage is on nearly level second bottoms along the Iowa River. Some areas are along gently sloping drainageways that lack well-defined outlets, on uplands near Homestead. Others occur at the base of sandy slopes.

Representative profile:

0 to 7 inches, very dark gray loam; friable.
7 to 13 inches, dark grayish-brown and very dark gray loam; friable.
13 to 34 inches, dark grayish-brown and light olive-brown loam; common yellowish-brown and few strong-brown mottles; friable.
34 to 44 inches, grayish-brown sandy loam; few yellowish-brown and strong-brown mottles; friable.
44 to 49 inches, mottled grayish-brown and yellowish-brown loamy fine sand; loose.

These soils tend to be slightly wet in spring and slightly droughty by midsummer. They puddle if worked when wet, and they become cloddy and hard when dry. In wet periods the water table is moderately high. Although farm operations may be slightly delayed because of wetness, ordinarily, tile drains are not needed in most areas. These soils are acid unless limed. They are low in available nitrogen and phosphorus and very low in potassium.

Udolpho loam (Ud).—This soil occurs on nearly level or gently sloping second bottoms and to a lesser extent on uplands. It has a 4- to 8-inch surface layer of very dark gray loam and a somewhat distinct, lighter colored subsurface layer. The slope ranges from 0 to 3 percent. Included in the areas mapped are Udolpho soils that have up to 30 inches of silty sediment on the surface. These areas are on uplands in the vicinity of Homestead.

Control of erosion is not a problem on this soil, but wetness is a slight hazard. In spring, field operations may be delayed because of wetness. The water table generally is moderately high but varies throughout the year. Tile lines have been used to drain some low areas and some areas near waterways. In years of below average rainfall, this soil is likely to be somewhat droughty.

This soil can be used intensively for row crops if fertility is maintained. Additions of organic matter are beneficial. A few areas are large enough to be farmed separately. Others are farmed with surrounding soils. Yields of corn vary but generally are above average. *Capability unit I–1.*

Wabash Series

The Wabash series consists of thick, very poorly drained, dark-colored soils derived from silty clay alluvium.

Representative profile:

0 to 24 inches, black and very dark gray silty clay; plastic when wet.
24 to 39 inches, very dark gray to dark-gray silty clay; very plastic when wet.
39 to 72 inches, gray and dark-gray silty clay; plastic when wet.

These soils are subject to frequent flooding. They absorb water very slowly and may become ponded during heavy rains. The water table is high. Tile drains do not function on these soils, but surface ditches can be used to remove excess water. These soils are slightly acid or neutral. They are low or medium in available nitrogen, medium in phosphorus, and low or very low in potassium. Even if drained, they are only moderately productive.

Wabash silty clay (Wa).—This soil occurs on bottom lands that have a gradient of less than 1 percent. Most areas are some distance from present river channels. The surface layer consists of thick, plastic silty clay.

This soil is difficult to work. It puddles easily if worked when wet, and it becomes hard and cloddy when dry. It is best suited to fall plowing. Tile drains will not function on this soil, but surface ditches can be used to prevent ponding after rains. Areas that are not drained are used for pasture. Drained areas are used mainly for corn and soybeans and occasionally for wheat. Yields of corn vary but generally are moderately low. Yields of soybeans and wheat are moderate. Alfalfa may be winterkilled. This soil occurs in small areas and commonly is farmed with adjacent soils. In years of above average rainfall, these areas are left idle. *Capability unit IIIw–1.*

Walford Series

In the Walford series are poorly drained, moderately dark colored or dark colored soils derived from loess. These soils have a distinct, light-colored subsurface layer. They occur in flat or depressed areas on high benches along the Iowa River, in the Amana Colonies.

Representative profile:

0 to 8 inches, very dark gray silt loam; friable.
8 to 15 inches, grayish-brown silt loam; common dark-brown mottles or oxides; very friable.
15 to 47 inches, grayish-brown silty clay loam; common brown, yellowish-brown, and few strong-brown mottles; friable to firm.
47 to 60 inches, light brownish-gray and yellowish-brown silt loam, friable.

These soils commonly receive runoff from adjacent soils. They absorb water slowly but, if artificially drained, can be used frequently for row crops. Both tile and surface drains can be used to remove excess water. Yields depend largely on management and on the amount of rainfall. These soils are medium acid. They are low in available

nitrogen, low or medium in phosphorus, and very low in potassium.

Walford silt loam, benches (Wb).—This soil occurs in flat or depressed areas, on high benches along the Iowa River. The slope is less than 1 percent. The surface layer is very dark gray, friable silt loam and is from 6 to 10 inches thick. The subsurface layer is grayish-brown silt loam. Included in the areas mapped are a few areas in which the surface layer is thicker and darker colored than that of this soil.

Rain that falls on surrounding soils often drains to this soil. In addition, runoff that originates on higher lying soils may collect on this soil. Consequently, this soil is very wet and needs to be drained by tile or open ditches. It puddles easily if worked when wet, and it becomes hard an cloddy when dry. Field operations may be delayed because of wetness. Individual areas are too small to be farmed separately and generally are farmed with surrounding soils. If artificially drained, this soil can be used frequently for row crops. In years of above normal rainfall, areas that are not properly drained are left idle. Yields of corn are moderate. *Capability unit IIIw-2.*

Watkins Series

In the Watkins series are well-drained soils that developed from water-deposited material on nearly level and gently sloping second bottoms along the Iowa River and its tributaries. These soils have a thin, dark-colored surface layer and an indistinct, moderately dark colored to light-colored subsurface layer.

Representative profile:

0 to 7 inches, very dark grayish-brown silt loam; friable.
7 to 18 inches, very dark grayish-brown and some dark yellowish-brown silt loam; friable.
18 to 65 inches, dark-brown to brown silty clay loam; few strong-brown mottles; friable to firm.

Some areas of these soils have no runoff, and others have only slight runoff. Consequently, the hazard of erosion is slight. These soils have a moderate or moderately slow rate of water intake, dry out fairly quickly after rains, and are easy to work. They are medium acid, and they are low or medium in available nitrogen and phosphorus and very low in potassium. Most of the acreage is used for row crops.

Watkins silt loam, 0 to 2 percent slopes (WkA).—This soil occurs on nearly level second bottoms. The surface layer is very dark gray silt loam and is from 4 to 8 inches thick. The subsurface layer is lighter colored silt loam and is indistinct. In most areas plowing has mixed the subsurface layer with the surface soil.

Most of the rain that falls on this soil is absorbed. Thus, control of erosion is not a problem. Tilth generally is good, but additions of organic matter are beneficial. Row crops can be grown frequently if fertility is maintained. Yields of corn are better than average if management is good. Individual areas of this soil are small, and much of the acreage is farmed with adjacent soils. *Capability unit I-1.*

Watkins silt loam, 2 to 5 percent slopes (WkB).—This soil occurs on short undulating slopes and on gently sloping escarpments of second bottoms. Included in the areas mapped are a few Watkins soils that have from 6 to 18 inches of light-colored sediment on the surface.

Although there is some runoff on this soil, control of erosion is not a serious problem. However, tillage needs to be done on the contour if row crops are grown. In a few areas, runoff that originates on soils upslope collects on this soil. This water can be intercepted by constructing diversion terraces on the higher lying soils. Most areas of this soil are too small to be farmed separately and are farmed with surrounding soils. If management is good, yields of corn are favorable. Additions of organic matter are beneficial. *Capability unit IIe-1.*

Waubeek Series

The Waubeek series consists of well drained or moderately well drained soils that developed from 20 to 40 inches of loess over loam glacial till. The slope ranges from 2 to 9 percent.

Representative profile:

0 to 7 inches, very dark grayish-brown silt loam; friable.
7 to 13 inches, dark-brown to brown silt loam; friable.
13 to 29 inches, grayish-brown and brown silty clay loam; few dark yellowish-brown mottles; friable.
29 to 75 inches, grayish-brown and yellowish-brown loam; few strong-brown mottles; friable to firm.

In years of excessive moisture, seepy spots may occur in places on side hills. This condition is caused by water flowing through the loess until it reaches the underlying glacial till, then moving laterally. These seepy areas may delay field operations in some places. Erosion is also a slight or moderate hazard on these soils. If erosion control practices are used, these soils are suited to row crops. They generally are low or very low in available nitrogen and phosphorus and low or very low in potassium, but they respond to fertilization. The Waubeek soils are acid unless limed.

Waubeek silt loam, 2 to 5 percent slopes (WmB).—This soil occurs on gently sloping, convex high areas and on intermediate areas on uplands. It has a 4- to 6-inch surface layer of very dark gray to very dark grayish-brown silt loam and an indistinct lighter colored subsurface layer. In plowed areas, these layers are mixed.

Runoff is slight on this soil. Nevertheless, if row crops are grown, this soil needs to be tilled on the contour to prevent excessive soil loss. It can be used intensively for row crops if it is terraced. Slopes are long and are suited to terracing. Yields of corn are favorable if management is good. Additions of organic matter are beneficial. This soil occurs in small areas and generally is farmed with adjoining soils. *Capability unit IIe-1.*

Waubeek silt loam, 5 to 9 percent slopes, moderately eroded (WmC2).—This soil occurs on long, smooth, slightly convex slopes. It is the major Waubeek soil in the county, but individual areas are not large. The surface layer consists of 3 to 6 inches of very dark grayish-brown silt loam. In cultivated areas, the subsurface layer commonly is mixed with the plow layer. In places the depth to loam glacial till is as little as 20 inches.

Runoff is moderate on this soil, and erosion control practices are needed. If row crops are grown, tillage needs to be done on the contour. Row crops can be grown more frequently if management is good. Additions of organic matter are beneficial. *Capability unit IIIe-1.*

Waukegan Series

The Waukegan series consists of well-drained or somewhat excessively drained, dark-colored soils that are underlain by fine and medium sand at a depth of 20 to 40 inches. These soils occur mainly on stream benches along the Iowa River and some tributaries. Some areas are on adjoining uplands, near the Amana Colonies. The slope ranges from 0 to 9 percent but is mostly between 0 and 5 percent.

Representative profile:

0 to 16 inches, very dark brown and dark-brown loam to silt loam; friable.
16 to 33 inches, brown silty clay loam and loam; friable.
33 to 60 inches, yellowish-brown fine sand and medium sand; loose.

Two Waukegan soil types were mapped in Iowa County. Waukegan silt loam occurs on uplands and consists of silty material that is underlain by leached fine sand and medium sand at a depth of 24 to 45 inches. Waukegan loam has a loam or, in places, a gritty silt loam surface layer and is underlain by coarse material at a depth of 20 to 40 inches. These soils absorb water at a moderately rapid or rapid rate. The sloping or strongly sloping Waukegan soils are underlain by sand at a depth of 20 to 30 inches and, consequently, are droughty even in years of normal rainfall. The Waukegan soils are strongly acid or medium acid unless limed. They are low or medium in available nitrogen and low or very low in phosphorus and potassium. Yields of row crops ordinarily are average or above average but depend largely on the amount of rainfall and on management.

Waukegan loam, 0 to 2 percent slopes (WnA).—This soil occurs on benches along the Iowa River. The surface layer is very dark gray to very dark brown loam or gritty silt loam. Leached fine sand and medium sand occur at a depth of 30 to 40 inches.

This soil has little or no runoff, and it absorbs water at a moderately rapid rate. It warms up quickly in spring and is easily worked. If well managed, it can be used intensively for row crops. Yields of corn are above average if rainfall is normal and is well distributed throughout the growing season. Most of the acreage is cultivated. *Capability unit I–1.*

Waukegan loam, 2 to 5 percent slopes (WnB).—This soil occurs on long, gently sloping or undulating benches. The surface layer of very dark brown, friable loam is from 10 to 14 inches thick. Leached medium and fine sand occur at a depth of 30 to 40 inches. A few areas in which sand occurs at a depth of 20 to 30 inches were included in the areas mapped. Also included are some soils that have a thinner surface layer and an indistinct subsurface layer.

This soil warms up quickly in spring and is easy to work. It has some runoff, however, and is susceptible to erosion. Tillage needs to be done on the contour if row crops are grown. Row crops can be grown more frequently if fields are terraced. Cuts for terraces should be held to a minimum to avoid exposing the sandy substratum. Some areas of this soil are large enough to be farmed separately. Yields of corn are above average, provided management is good and rainfall is normal. *Capability unit IIe–1.*

Waukegan loam, 5 to 9 percent slopes (WnC).—This soil occurs on convex slopes on uplands near the Iowa River. It has an 8- to 12-inch surface layer of very dark brown to very dark grayish-brown loam to gritty silt loam. Included in the areas mapped are small areas that slope as much as 15 percent. Also included are a few Waukegan soils that have a 3- to 6-inch surface layer, and some soils that have an indistinct, light-colored subsurface layer.

This soil warms up quickly in spring and is easy to work, but it tends to be moderately droughty. Moisture stresses commonly occur in midsummer. If row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced. It can be used more frequently for row crops if fields are terraced. Although terraces are easily constructed, cuts should be held to a minimum to avoid exposing the sandy substratum. Yields of corn vary but are often moderate, provided management is good and rainfall is well distributed throughout the growing season. Additions of organic matter are beneficial. *Capability unit IIIs–2.*

Waukegan silt loam, 2 to 5 percent slopes (WsB).—This silty soil is underlain by leached medium and fine sand at a depth of 24 to 45 inches. It occurs mainly as a narrow band, about 1 mile wide, along U.S. Highway 6. This band extends from the junction of State Highway 149 eastward to the county line. A few areas also occur near Price Creek in Lenox Township. Most slopes are long and smooth.

This soil warms up early in spring and is easy to work, but it is readily eroded by runoff and is slightly droughty. If used for row crops it needs to be tilled on the contour, stripcropped on the contour, or terraced. The long, smooth slopes are well suited to terracing, but cuts should be held to a minimum to avoid exposing the sandy substratum. Most of this soil is cultivated. Yields of corn are above average, provided management is good. However, even in years of average rainfall, crops may be affected by lack of moisture by midsummer, unless rains are timely. *Capability unit IIs–1.*

Waukegan silt loam, 5 to 9 percent slopes (WsC).—This soil occurs mainly as a narrow band, about 1 mile wide, along U.S. Highway 6. This band extends from the junction of State Highway 149 eastward to the county line. A few areas are near Price Creek in Lenox Township. This soil has an 8- to 16-inch surface layer of very dark brown to very dark grayish-brown silt loam. Leached medium and fine sand occur at a depth of 24 to 36 inches. Included in the areas mapped are some moderately eroded soils that have a 3- to 6-inch surface layer, and a few soils that have an indistinct light-colored subsurface layer.

This soil warms up early in spring and is easily worked, but it is moderately droughty and is readily eroded by runoff. If row crops are grown, fields need to be tilled on the contour, stripcropped on the contour, or terraced. Row crops can be grown more frequently if fields are terraced. The long, smooth slopes are well suited to terracing, but cuts should be held to a minimum to avoid exposing the sandy substratum. Crops are affected by lack of moisture by midsummer unless rainfall is above normal and rains are timely. Additions of organic matter are beneficial. *Capability unit IIIs–2.*

Wiota Series

The Wiota series consists of well drained or moderately well drained, dark-colored soils that formed from silty alluvium on second bottoms. The slope ranges from 0 to 5 percent.

Representative profile:

0 to 16 inches, very dark brown silt loam; friable.
16 to 45 inches, dark-brown and brown silty clay loam; few grayish-brown mottles below a depth of 35 inches; friable.
45 to 55 inches, dark yellowish-brown loam; common yellowish-brown and strong-brown mottles; friable.

The Wiota soils are among the most productive soils in the county. Most of the acreage is used for corn and soybeans. Yields are better than average if management is good. These soils absorb water at a moderate rate. They are medium acid, and they are low or medium in available nitrogen and phosphorus and very low in potassium. The gently sloping Wiota soils are susceptible to slight erosion.

Wiota silt loam, 0 to 2 percent slopes (WtA).—This is the major Wiota soil in Iowa County. It occurs on second bottoms or low benches along the Iowa River and its tributaries. The slope is dominantly 1 percent or less. The surface layer is black to very dark brown silt loam and is 14 to 18 inches thick. Included in the areas mapped are a few soils that have from 6 to 18 inches of light-colored silty overwash on the surface.

Many areas of this soil are large enough to be farmed separately. Control of erosion is not a problem, and most of the acreage is cultivated. This soil is well suited to row crops. If management is good, row crops can be grown frequently. Yields of corn are better than average. Diversion terraces, placed on soils upslope, help to protect this soil from siltation. *Capability unit I–1.*

Wiota silt loam, 2 to 5 percent slopes (WtB).—This soil occurs on undulating or gently sloping second bottoms and on low benches. The surface layer is very dark brown friable silt loam and is from 10 to 14 inches thick. Some Wiota soils that occur on convex slopes were included in mapping.

This soil is readily eroded by runoff. It is suited to row crops but needs to be tilled on the contour or terraced to help control erosion. If fields are terraced, row crops can be grown more frequently. Terraces may be difficult to establish in some places, however, because of the shape and length of the slopes. Most of this soil is cultivated, and some areas are large enough to be farmed separately. Yields of corn are better than average if management is good. *Capability unit IIe–1.*

Zook Series

The Zook series consists of poorly drained, dark-colored soils that formed from alluvium in slack-water areas. These soils occur in small, nearly level or slightly depressed areas along the major streams in the county, but principally along the English River.

Representative profile:

0 to 19 inches, black to very dark gray silty clay loam; firm.
19 to 45 inches, very dark gray and dark gray light silty clay; very firm.
45 to 50 inches, gray silty clay loam to silty clay; many yellowish-brown and strong-brown mottles; firm.

The Zook soils have a slow or very slow rate of water intake and often are ponded for several days after rains. The water table generally is high. If artificially drained, these soils are well suited to row crops. They are slightly acid and are low or medium in available nitrogen, medium in phosphorus, and low or very low in potassium.

Zook silty clay loam (Zk).—This soil occurs mainly in level or slightly depressed areas on bottom lands along the English River. These areas are away from the stream channel and just below escarpments that border second bottoms.

Wetness is the major limitation on this soil. Although tile drains reduce wetness, they function slowly, and outlets are difficult to establish. Even if tile lines are installed, this soil will be slightly wet at times, and field operations will often be delayed. Surface drains can be used in places to remove excess water. Land leveling to produce a gradient will prevent ponding. This soil warms up slowly in spring, puddles easily if worked when wet, and is likely to become hard and cloddy when dry. Plowing is sometimes done in fall so that winter freezing and thawing will break up clods. Alfalfa may be winterkilled in wet years. If artificially drained, this soil can be used intensively for row crops. It is often farmed with adjacent soils. *Capability unit IIw–2.*

Zook silt loam, overwash (Zo).—This soil occurs mainly near the base of steep uplands, and it receives both overwash and runoff from these areas. From 6 to 20 inches of very dark brown silt loam overwash has accumulated on the surface. This soil is not so wet as other Zook soils, and it is not so readily puddled. Consequently, it is more easily worked and generally can be plowed or planted earlier in the year than Zook soils that are free of overwash.

Diversion terraces, placed on soils upslope, will help to intercept runoff that originates on the higher soils. Tile drains are needed to remove excess water from this soil, but they function slowly. If drained and protected from siltation, this soil can be used intensively for row crops. In normal years, yields are about the same as those for other Zook soils, but in wet years they will be a little higher. Generally, they are above average. This soil occurs in small areas and commonly is farmed with adjacent soils. Corn and soybeans are the principal crops. *Capability unit IIw–2.*

Use and Management of Soils

This section discusses some soil properties that affect the management of the soils in the county and describes some basic practices of management. It also describes the system of capability classification used by the Soil Conservation Service; discusses the use and management of groups of soils, or capability units; and includes a table showing management and yield data for all of the soils in the county. In addition, woodland management is discussed, and the soils are grouped to show their suitability for specified trees and shrubs.

Soil Properties That Influence Management

The suitability of a soil for crops cannot be determined only by the appearance of its surface layer. The entire

soil to a depth of 4 to 6 feet is significant. In many of the soils of Iowa County, the surface layer is similar, but the lower layers differ greatly. This difference commonly determines whether a soil is well suited or poorly suited to crops. For example, the Kenyon and Adair soils both have a loamy surface layer but differ greatly in the production of crops because of the difference in their lower layers. The Kenyon soils have a loamy subsoil that is permeable to water, roots, and air. By contrast, the Adair soils have a subsoil of tough, dense, heavy, reddish-brown clay that is difficult for roots and water to penetrate. Consequently, the Adair soils stay wet and soggy in spring. Plants on the Adair soils often turn yellow from lack of air and nitrogen.

Following are some soil properties that are most significant in soil management.

Color and thickness of the surface layer.—Soils that have a thick, dark-colored surface layer are considered most desirable by farmers, provided the subsoil is also suitable. The surface layer generally is thick and dark colored in soils formed under tall prairie grasses and thin and light colored in soils formed under timber. For example, the dark-colored Otley soil is a prairie soil, whereas the light-colored Clinton soil is a forest soil.

Prairie soils typically are high in organic-matter content. They generally have better structure than soils formed under timber and commonly are more productive, even after years of cropping. Nevertheless, fresh supplies of organic matter are needed by both light-colored and dark-colored soils. Organic matter can be supplied by turning under crop residues, by growing green-manure crops, and by additions of barnyard manure. Nearly all of the nitrogen in the soil is in the surface layer. Thus, crop yields are reduced if the surface soil is removed, and additional nitrogen is not supplied.

Depth.—Some soils, such as the Lawler, Udolpho, and Waukegan, are underlain by sand at a depth of 20 to 40 inches. Others are silty to a depth of 4 feet or more. Although the texture of the surface layer of both shallow and deep soils may be similar, the shallow soils do not hold enough water in dry years to supply the moisture needed for good crop growth. Consequently, in dry years yields of crops will be lower on the shallow soils.

Texture.—Soil texture is a soil property that affects both yields and management. Soils that have a sandy texture, such as the Chelsea, hold little water and thus need special management. They generally are droughty and are limited in their use for crops. Unless protected, they are likely to blow when seeded in spring. In addition, seedings are difficult to establish on sandy soils. Soils that have a silty clay texture, such as the Wabash, are often wet because water moves slowly through the profile. Soils that have silt loam or silty clay loam texture, such as the Ladoga and Otley, are most common in the county. These soils are most desirable for general crops. To be kept in good tilth, they require only such management as the careful use of tillage implements, additions of barnyard manure, and a rotation that includes sod crops.

Slope and erosion.—Soil erosion by water is directly related to the steepness and length of the slope. Sheet erosion and rilling are more severe on steep slopes than on gentle slopes. Long slopes are also much more likely to be damaged than short slopes. If soils that have strong slopes are cultivated, management practices are needed to reduce the loss of soil and water, to maintain fertility, and to prevent the formation of gullies. Runoff can be largely controlled by tilling on the contour, stripcropping, terracing, and the use of diversions. Modern machinery generally is best suited to level and gently sloping areas but is moderately well suited to uniform slopes of as much as 10 percent, provided these areas are not gullied. Special management is needed to restore productivity to severely eroded soils.

Basic Practices of Management

Farmers should select management practices that are suited to their soils. This subsection discusses some of the basic practices of management that are used in Iowa County. More specific suggestions for groups of soils are given in the subsection "Management by Capability Units," and some suggestions for individual soils are given in the section "Descriptions of the Soils."

Liming and Fertilizing.—Most soils in Iowa County have been farmed for 100 years or more. Consequently, many of the soils are now more acid than they were originally, and much of the natural supply of readily available plant nutrients has been exhausted. Lime and commercial fertilizers that contain phosphorus, potash, and nitrogen are widely needed and used. The amounts needed can be determined by soil tests. It is desirable to have the soil tested once during the rotation, or about every 3 to 5 years. The soil map is the best guide for soil sampling. Samples from different soil areas should not be mixed.

Available nitrogen (N) typically is nil below a depth of 12 inches. Dark-colored prairie soils, such as the Tama and Muscatine, have slightly more available nitrogen in the plow layer than do forest soils or forest-grass transition soils. Soils on bottom lands have larger amounts of nitrogen in the 6- to 12-inch layer than soils on uplands.

Available potassium (K) commonly decreases rapidly below the plow layer. Below a depth of 24 inches, the supply is as low or lower than at a depth of 12 to 24 inches. Most soils in Iowa County are low or very low in available potassium at a depth of 12 to 24 inches. Forest soils are lower in available potassium than prairie soils, and prairie-forest transition soils are intermediate. Moderate potassium deficiencies may occur in soils that have a low level of available potassium in the soil profile, particularly if those soils are in nonmanured first-year corn or in corn that has been heavily fertilized with nitrogen and phosphate.

Available phosphorus (P) in the subsoil varies widely among soil types and also within soil types. It decreases below the plow layer in the loessal Taintor, Mahaska, Muscatine, Otley, and Tama soils, which developed under grass on uplands, and then increases between a depth of 20 and 30 inches in all of these soils, except the Taintor. In the Shelby, Adair, Gara, Lindley, Bassett, Kenyon, and other soils that developed in glacial till, available phosphorus generally is very low both in the plow layer and throughout the subsoil. If crops are grown on these soils, additions of phosphate are needed. In the Clinton, Fayette, and other loessal soils that developed under forest, available phosphorus commonly increases below the plow layer and in the lower part of the subsoil. The Ladoga, Downs, Givin, and Atterberry soils developed in loess

under mixed vegetation of forest and grass. Therefore, phosphorus distribution in the subsoil is intermediate between that of soils developed under grass and soils developed under forest. Available phosphorus in soils on bottom lands varies considerably but generally is low or medium below the plow layer.

Soils in Iowa County generally need lime if legumes are grown, unless they have been limed within the previous 5 years. An exception is the Hopper soils, which have a sufficient amount of lime in the surface layer and an excess amount in the subsoil.

The optimum rate of application of nitrogen for corn varies from 0 to 40 pounds per acre if corn follows meadow to as much as 80 to 120 pounds per acre if corn has been grown for 4 years or more. However, the optimum rate also depends to some extent on (1) the quality of the preceding legume meadow and number of years of legume meadow; (2) the amount of manure applied; (3) the stand level (an additional 10 to 15 pounds of nitrogen is needed for each 1,000 stalks above 16,000 stalks per acre); (4) the soil type and past erosion; and (5) the availability of phosphorus and potassium in the soil.

The amount of phosphorus and potassium fertilizers needed for the most profitable yield of corn varies but generally falls within the following ranges: If soil tests indicate the plow layer is very low in those elements, the optimum rate is 40 to 100 pounds of phosphorus and 60 to 80 pounds of potassium per acre; if the plow layer is low in those elements, the optimum rate is 30 to 60 pounds of phosphorus and 40 to 60 pounds of potassium per acre; if medium, 20 to 40 pounds of phosphorus and 20 to 40 pounds of potassium per acre; and if high, 15 to 20 pounds of phosphorus and 15 to 20 pounds of potassium per acre.

The rate suggested if the soil test level is very low applies to soils in which available phosphorus and potassium are very low throughout and below the subsoil. The rate suggested if the soil test level is high applies to soils in which the amount of available phosphorus increases below the plow layer or where the amount of available potassium generally decreases to a low level in the 6- to 12-inch layer. The results of the soil tests depend to some extent on the amount of manure applied; the carryover from previous applications of manure and fertilizer; the previous crop; and the season. Applications of 20 to 30 pounds of phosphorus and potassium per acre can be made most efficiently with a planter attachment. Larger applications can be split and part applied with a planter attachment and the rest plowed under, or all can be plowed under.

Crop rotations.—A suitable cropping system is part of good soil management. In Iowa County, yields of first-year corn following a meadow crop generally are the highest in the rotation. On many farms, however, legume nitrogen from the meadow crop is not used efficiently because the soils are low in phosphorus and potassium. If the nitrogen from manure and fertilizer is adequate, yields of second-year corn can be nearly as high as those of first-year corn, provided corn rootworms are controlled. On sloping soils, a rotation that emphasizes the use of meadow crops is needed in addition to other erosion control practices.

Control of runoff and erosion.—The control of water runoff early in the season helps to increase the amount of moisture held in the subsoil. This subsoil moisture is particularly important in July and August, when the water requirements of corn generally exceed the amount of rainfall. In turn, increased corn residues from heavier stands of corn help to conserve both soil and water.

Erosion commonly increases the need for all soil nutrients and increases the cost of crop production over the years. Soil tests indicate that nitrogen, phosphorus, and potassium levels normally are higher in the surface layer than in the underlying layer. Thus, rapid erosion of the surface layer will result in the nutrient-deficient subsurface layer becoming the plow layer.

Terracing is widely needed throughout the county to help reduce soil losses. Corn can be grown more frequently in the rotation if fields are terraced than if other conservation practices are used. Soils that have a slope of more than 12 percent are not well suited to terracing, and fine-textured soils, such as the Adair and Keswick, are poorly suited. Terraces are difficult to construct and to maintain on sandy soils.

All erosion control practices should be planned to fit the needs of an individual farm. A representative of the Soil Conservation Service assisting the Iowa County Soil Conservation District can provide the technical help needed to make such a plan.

Principles of tillage.—Tillage of the soil is one of the oldest occupations known to man. Tillage operations are undertaken to change soil structure, to help manage crop residues, and to control weeds and other undesirable vegetation.

Soils tend to become less granular and more compact as they are farmed. As a result, tillage operations that loosen the soil are necessary. These operations should be performed when the soil is neither too wet nor too dry. If possible, level fine-textured soils, such as the Wabash, Zook, Taintor, and Colo, can be plowed sufficiently ahead of final seedbed preparation to permit alternate freezing and thawing or alternate wetting and drying to break up clods. Minimum tillage is important to prevent overcompaction of the soils. Subsoil tillage, even if the subsoil is fertilized, has not proven satisfactory in Iowa County.

Although the decomposition of crop residues and other organic material is hastened by the thorough mixing of the residual material with the soil, this mixing may leave the soil barren and subject to erosion. Thus, minimum tillage that leaves some residue on the surface is desirable to help control soil loss. On the other hand, mulch left on the surface tends to slow down decomposition of residues and to delay the warming up and drying out of the soils in spring. Consequently, the benefit derived in control of erosion is somewhat offset by slightly reduced yields.

Tillage operations are valuable in the control of weeds and other undesirable vegetation that compete with crops for light, water, and nutrients. The severity of weed infestation in a field may determine the extent of tillage needed in preparing a seedbed. Pre-emergent spray for the control of weeds helps to reduce the need for tillage.

Capability Grouping of Soils

The capability classification is a grouping of soils that shows, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c* because the soils in it are subject to little or no erosion but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example IIe–1 or IIe–2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil, and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system and the subclasses that are represented in this county are described in the list that follows:

Class I. Soils that have few limitations that restrict their use.
  (No subclasses.)

Class II. Soils that have moderate limitations that reduce the choice of plants or require moderate conservation practices.
  Subclass IIe. Soils subject to moderate erosion if they are not protected.
  Subclass IIw. Soils that have moderate limitations because of wetness.
  Subclass IIs. Soils that have moderate limitations of moisture capacity.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
  Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.
  Subclass IIIw. Soils that have severe limitations because of excess water.
  Subclass IIIs. Soils that have severe limitations of moisture capacity or tilth.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
  Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.
  Subclass IVs. Soils that are very severely limited because of low moisture capacity and extreme droughtiness.

Class V. Soils not likely to erode that have other limitations, impractical to remove, that limit their use largely to woodland, pasture, or wildlife habitats.
  Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture, woodland, or wildlife habitats.
  Subclass VIe. Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.
  Subclass VIs. Soils generally unsuitable for cultivation and limited for other uses by their low moisture capacity.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to grazing, woodland, or wildlife.
  Subclass VIIe. Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.
  Subclass VIIs. Soils very severely limited by moisture capacity.

Class VIII. Soils and landforms that, without major reclamation, have limitations that preclude their use for commercial production of plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes. (There are no class VIII soils in Iowa County.)

Management by capability units

In the following pages the soils of the county are grouped in capability units. The soils in each unit are described generally, and use and the management of the capability unit are discussed. The soils in a unit are referred to by series name, but this does not imply that all the soils of a series are in a capability unit. Refer to the Guide to Mapping Units at the back of this report for the names of mapping units and the capability units in which they have been placed.

CAPABILITY UNIT I–1

This unit consists of deep, nearly level soils of the Atterberry, Bertrand, Givin, Koszta, Lawler, Mahaska, Muscatine, Nevin, Tama, Udolpho, Watkins, Waukegan, and Wiota series. These soils are on uplands and on stream benches. They have a friable, medium-textured surface layer and a friable, medium-textured or moderately fine textured subsoil. After heavy rains or during thaws

in spring, runoff from higher areas collects in places but generally does not stand on the surface for long periods.

These soils are easy to till and are readily penetrated by roots to a depth of several feet. They are among the most productive soils in the county. All of the soils are high in moisture-holding capacity except the Waukegan soil, which is moderate. Drainage generally is adequate, but in wet years tile drains are beneficial in some places. Erosion is not a hazard.

The soils in this unit are well suited to cultivated crops. The use of liberal amounts of fertilizer helps to maintain economic yields if these soils are used intensively for corn and soybeans. The Bertrand soil is lighter colored and lower in organic-matter content than the other soils. It can be used for row crops much of the time if manure is applied or if crop residues are turned under and fertilizer is added.

If row crops are grown for several years, tillage needs to be kept to a minimum to prevent the soils from compacting. Insects and plant diseases are difficult to control in fields where corn in grown for several years. Soybeans commonly are substituted for corn in the rotation. Soils that are heavily cropped and that are plowed to the same depth for successive years tend to develop a compact layer, or plowpan. This layer restricts the movement of air and water. Alternating the depth of plowing helps to prevent the formation of a pan.

Liberal applications of commercial fertilizer are needed to maintain favorable yields. If corn follows a legume in the rotation, then nitrogen fertilizer generally is not needed, but phosphate or potash is often required. These soils generally need lime, particularly if seeded to a legume.

CAPABILITY UNIT I–2

In this unit are nearly level Amana, Lawson, and Nodaway soils. These soils occur on flood plains and are occasionally overflowed. They are moderately well drained or somewhat poorly drained but generally can be cropped without supplemental drainage. However, they are benefited by drainage in wet years. The use of dikes to protect them from overflow may be profitable, but ordinarily floods occur early in spring before corn is planted and last only a short time. In some years planting is delayed because of flooding.

These are among the most productive soils in the county. They are not subject to either drought or erosion. They can be used intensively for corn and soybeans, and they also provide good pasture but generally are not used for this purpose. Corn is the most important crop. If corn is grown in the same field for several years, however, plant diseases and insects are difficult to control. Control of weeds is important because floodwaters commonly carry undesirable seed. If these soils are plowed in fall instead of in spring, planting can be undertaken earlier.

Liberal amounts of fertilizer are needed on these soils to maintain productivity. Nitrogen is especially needed in fields that are used intensively for corn. The response to phosphate and potash is also good if corn is grown. All of the soils need lime unless limed within the last 5 years.

CAPABILITY UNIT IIe–1

This unit is made up of gently sloping Downs, Dinsdale, Judson, Kenyon, Ladoga, Otley, Tama, Watkins, Waukegan, Waubeek, and Wiota soils. These soils are dark colored or moderately dark colored and are well drained or moderately well drained. They have a friable, medium-textured surface layer and a friable to firm, medium-textured or moderately fine textured subsoil. Runoff is sufficient to cause soil erosion.

The soils in this unit are medium or high in organic-matter content. They absorb much of the rain that falls, but some runoff occurs because of the slope. Permeability is moderately slow in the Ladoga and Otley soils but moderate in the other soils. The moisture-holding capacity is moderate in the Waukegan soil but high in the other soils.

These soils are productive and are well suited to all crops commonly grown in the county. They can be used for row crops much of the time if protected from erosion. If farmed on the contour, they need to be kept in a meadow crop 1 year in 5. If terraced, they can be used intensively for corn. Soybeans are often substituted for corn. Stripcropping generally is not suitable. Favorable yields can be obtained, provided an adequate amount of fertilizer is used and other management is good.

Good tilth can be maintained on soils that have been used several years for row crops if all residues are returned to the soil or liberal amounts of manure are applied.

CAPABILITY UNIT IIe–2

This unit is made up of light-colored to moderately dark colored, gently sloping Bertrand, Clinton, and Fayette soils. These soils have a friable, medium-textured surface layer and a medium-textured or moderately fine textured subsoil. The subsoil is moderately permeable in all of the soils, except the Clinton. In the Clinton soil, it is moderately slowly permeable. The soils in this unit are well drained or moderately well drained and have high moisture-holding capacity. They are suited to all of the crops commonly grown in the county but are subject to some sheet erosion because of the slope.

These soils can be used for row crops much of the time if they are protected from erosion. If row crops are grown often in the rotation, tilling on the contour, stripcropping, or terracing is needed to help prevent soil loss. Corn is the principal crop, but soybeans are sometimes substituted for corn in the rotation.

Because of the low organic-matter content of these soils, it is important to return all crop residues to the soil. Row crops can be grown 3 years in 5 if terraces are constructed, adequate amounts of fertilizer are applied, and all crop residues are returned to the soil. Liberal amounts of commercial fertilizer help to maintain economic yields. Lime is also needed for satisfactory corn yields and to establish legumes.

CAPABILITY UNIT IIw–1

This unit consists of somewhat poorly drained or poorly drained Colo, Coppock, Ely, and Nodaway soils. These soils occur along drainageways and on alluvial fans, on the uplands. All of the soils except the Colo have a friable, medium-textured surface layer and subsoil. The Colo soil is moderately fine textured, friable to firm, and moderately slowly permeable.

The soils of this unit are wet mainly because of a seasonal high water table. They commonly are flooded for short periods by water that flows from higher areas to

creeks and large streams. They occur where water concentrates and thus are subject to gullying. Siltation is also a hazard if heavy rains occur when crops are small and adjoining higher soils are not protected from erosion.

Permanent grassed waterways are needed on these soils. Diversions will help to control runoff from nearby slopes and to prevent siltation. Because the movement of air and water is somewhat restricted, these soils tend to dry out slowly in spring. They are benefited by tile drainage if the lines are properly installed. In places erosion control structures are needed in addition to grassed waterways to prevent the formation of gullies at tile outlets.

The soils in this unit are highly productive but generally are farmed with adjoining soils. Areas that are suitable for farming can be used intensively for corn, soybeans, and other row crops.

CAPABILITY UNIT IIw-2

In this unit are poorly drained or somewhat poorly drained, dark colored and moderately dark colored soils of the Bremer, Colo, Nodaway, and Zook series. All of these soils have a moderately fine textured surface layer except the Nodaway, which has a medium-textured surface layer. The soils in this unit occur on first and second bottoms and are occasionally flooded. They are wet mainly because of overflow and because the water table generally is high. Flooding commonly occurs early in spring but ordinarily lasts for only short periods. After floods recede, water remains ponded for several days in the small slightly depressed areas. The Bremer soils are less likely to be flooded than the other soils.

Although the soils in this unit have high or very high water-holding capacity and slow internal drainage, they can be drained by tile if suitable outlets are available. The Zook soils drain more slowly than the other soils. Thus, tile lines in these soils need to be more closely spaced. Surface drainage is needed in addition to tile lines in the flat or depressed areas. Diversions and levees are needed in some places because runoff from higher areas frequently collects on these soils. Siltation is a hazard if heavy rains occur when crops are small and adjoining higher soils have not been protected from erosion.

If adequately drained and well managed, these soils can be used intensively for row crops. Corn is the most important row crop, but soybeans are often substituted for corn. Crops respond well to fertilizer, and in years when flooding is not excessive, favorable yields can be expected. Nitrogen is especially beneficial if corn has not been preceded by a legume. Planting generally can be undertaken earlier in spring if the soils are plowed the previous fall when moisture conditions normally are more favorable.

CAPABILITY UNIT IIw-3

The poorly drained, nearly level, dark-colored Taintor soil is the only soil in this unit. This soil has a friable to firm, moderately fine textured, highly organic surface layer and a slowly permeable, moderately fine textured subsoil. Aeration in this soil is somewhat restricted. Surface runoff is slow, and in places water remains ponded after heavy rains.

This soil is slow to dry out in spring and puddles readily if worked when wet. It can be satisfactorily drained by tile. Where artificial drainage is installed, field operations can be much more timely. The water table is perched in spring but recedes during the growing season. Thus, fall plowing often insures earlier planting in spring. Erosion is not a hazard.

If liberal amounts of commercial fertilizer are applied, this soil can be used intensively for corn and soybeans. Lime generally is needed for best yields.

CAPABILITY UNIT IIw-4

This unit consists of somewhat poorly drained, light-colored to moderately dark colored Jackson, Keomah, and Stronghurst soils on nearly level uplands and terraces. These soils have a friable, medium-textured surface layer and a medium-textured or moderately fine textured subsoil. They are low in organic-matter content and are high in water-holding capacity. They may be wet for short periods during the early part of the growing season because of a seasonal high water table.

These soils warm up a little more slowly in spring than the dark-colored soils. Although they are moderately well suited to row crops, green-manure crops and crop residues are needed to maintain good tilth if row crops are grown frequently. A meadow crop is more important on these soils than on the darker colored soils. Field operations generally can be undertaken earlier in spring if these soils are drained. Tile can be used for this purpose, provided suitable outlets can be established.

If used intensively for row crops, these soils puddle readily after rains. A crust, which commonly forms as these soils dry, often retards the emergence of seedlings. This crust has less effect on crop growth if seedlings have already emerged, and it is less noticeable in areas where a meadow crop is included in the rotation. A rotary hoe or other such mechanical means can be used to break the crust.

These soils require liberal amounts of fertilizer if used intensively for corn. Nitrogen is particularly needed if corn does not follow a legume. The response to fertilizer is good. Lime generally is needed for best yields.

CAPABILITY UNIT IIs-1

This unit consists of dark-colored and light-colored Tell and Waukegan soils that are on gently sloping high benches on the uplands. These soils have a friable, medium-textured surface layer and subsoil and are underlain by sand at a depth of 24 to 45 inches. They have a moderately permeable subsoil and a rapidly permeable substratum. The Tell soil is low in organic-matter content, and the Waukegan soil is moderate. Both soils are subject to slight erosion and are somewhat droughty.

These soils are suited to cultivated crops. They warm up early in spring and can be worked soon after rains. They have good tilth and are easy to work but are droughty, particularly in years of average or below average rainfall. Because their moisture-holding capacity is moderate or low, they are less productive in dry years than the soils in subclass IIe, even though management is the same.

Most of this acreage is used for cultivated crops. Corn is the main crop, but soybeans, oats, hay, and pasture are also suitable. Although these soils are productive, yields depend largely on the amount and timeliness of rainfall. Practices to control erosion are needed if row crops are grown. Corn can be grown frequently in the rotation if fields are tilled on the contour or terraced.

CAPABILITY UNIT IIIe-1

This unit consists of deep, dark colored and moderately dark colored soils of the Bassett, Downs, Dinsdale, Gara, Kenyon, Ladoga, Otley, Shelby, Tama, and Waubeek series. These soils have a friable, medium-textured surface layer and a friable, moderately fertile, medium-textured or moderately fine textured subsoil. The slope ranges from 5 to 9 percent. Some of these soils are moderately eroded, and some spots are severely eroded. All of the soils are well aerated and, except in the severely eroded spots, have good tilth. They are easy to cultivate, even though the organic-matter content ranges from very low to high. The rate of water intake normally is good, but some runoff occurs because of the slope. The moisture-holding capacity is high. The soils of this unit make up the largest acreage in the county.

These soils are well suited to most crops grown in the county. Corn is grown most frequently, but soybeans are sometimes substituted for corn in the rotation. To help control erosion in cultivated fields, the soils need to be tilled on the contour, stripcropped, or terraced. If terraced, these soils can be used for row crops at least half the time without serious soil loss. As a whole, the soils in this unit are better suited to terracing than any of the other soils in the county. However, the Gara and Shelby soils are not so well suited as the other soils, because they have a less productive subsoil and are less responsive to treatment. Grassed waterways are needed to prevent the formation of gullies in areas where water concentrates. Yields are average or above average in areas where adequate amounts of fertilizer are applied, a suitable cropping system is used, and other management is good. Lime generally is needed for best yields.

CAPABILITY UNIT IIIe-2

This unit is made up of deep, light-colored to moderately dark colored soils of the Bertrand, Clinton, and Fayette series. These soils have a friable, medium-textured surface layer and a friable to firm, moderately fertile, medium-textured or moderately fine textured subsoil. The slope ranges from 5 to 9 percent. The movement of air and water through these soils is good, and the moisture-holding capacity is high. Erosion is a hazard, however, because slopes are strong and the surface layer is somewhat poorly granulated and is low in organic-matter content. In places, both fertility and permeability have been lowered through erosion. Although tilth commonly is fair or poor, these soils are easily cultivated.

The soils in this unit are suited to crops commonly grown in the county, but they need to be stripcropped, tilled on the contour, or terraced if row crops are grown. Although row crops can be grown more frequently in fields that are terraced, these soils generally are better suited to stripcropping and to contour tillage. Where terraces can be constructed, row crops can be grown 2 years in 4, provided all residues are returned to the soil and adequate amounts of fertilizer are applied. If favorable yields cannot be maintained, a meadow crop can be grown for an additional year.

Because the organic-matter content is low, more meadow crops are needed in the rotation on these soils than on the dark-colored soils in unit IIIe-1.

Favorable yields can be expected on the soils of this unit if management is good. Adequate amounts of fertilizer are needed for the best yields of both crops and pasture. Lime generally is needed, particularly if legumes are grown. Crop residues, left on the surface, help to control erosion by improving the rate of water intake and by reducing runoff.

CAPABILITY UNIT IIIe-3

This unit consists of dark colored and moderately dark colored soils of the Bassett, Downs, Gara, Kenyon, Ladoga, Otley, Shelby, and Tama series. These soils have a friable, medium-textured surface layer and a medium-textured or moderately fine textured subsoil. The subsoil is moderately fertile and is moderately permeable or moderately slowly permeable. The slope ranges from 9 to 14 percent. The movement of air and water through these soils is good, and the moisture-holding capacity is high. Erosion is a serious hazard, and in some areas the rate of water intake has been reduced somewhat because of the crusting of the eroded surface. These soils are similar to the soils of unit IIIe-1, except that the slopes are stronger and the choice of crops and rotations is more limited.

The soils in this unit are suited to the same crops as the soils of unit IIIe-1, but they are more susceptible to erosion. Many of these soils have long, smooth slopes that are suited to terracing. If fields are terraced, corn can be grown for 1 year in 4 on the Bassett, Gara, Ladoga, Otley, and Shelby soils and for 2 years in 5 on the Downs, Kenyon, and Tama soils. The Gara and Shelby soils are less well suited to terracing than the other soils.

Favorable yields can be expected on these soils, if an adequate amount of fertilizer is applied, a suitable cropping system is used, and other management is good. Lime generally is needed and is especially important if legumes are grown.

CAPABILITY UNIT IIIe-4

This unit is made up of deep, light-colored to moderately dark colored Clinton, Fayette, and Hopper soils that have a slope range of 9 to 14 percent. These soils have a friable, medium-textured surface layer and a moderately fertile, medium-textured or moderately fine textured subsoil. The movement of air and water through these soils is good, and the moisture-holding capacity is high. However, the organic-matter content is low, and the surface tends to crust after rains. These soils are similar to the soils of unit IIIe-2, except that they occur on stronger slopes. Consequently, erosion is a more serious hazard.

These soils are moderately well suited to cultivated crops if erosion is controlled. If used for row crops, they need to be tilled on the contour, stripcropped, or terraced. Corn can be grown more frequently in the rotation where fields are terraced, but most areas are better suited to stripcropping than to terracing. If erosion control practices are not used, these soils should be kept in meadow.

Lime generally is needed to establish legumes on all of the soils, except the Hopper. The Hopper soils commonly have an adequate amount of lime in the surface layer and more than an adequate amount in the subsoil. The use of barnyard manure, green manure, or crop residues is important on all of the soils in this unit because the organic-matter content is low. Moderate yields can be obtained if fertilizer is applied and other management is good.

CAPABILITY UNIT IIIe-5

This unit consists only of the moderately sloping, slowly permeable Adair soil. This soil has a friable, medium-textured surface layer but a firm clayey subsoil that retards the downward movement of water. It is moderately well drained but is seasonally wet because of seepage from more permeable soils upslope. Runoff is fairly rapid, and erosion is difficult to control.

This soil commonly occurs in narrow bands and is closely associated with the Otley soils upslope and with the Shelby soils downslope. In most places the rotation is determined by the associated soils, which make up the larger part of the landscape. If this soil is used for row crops, tillage should be done on the contour. Terracing generally is not satisfactory because of the heavy, compact subsoil. The response to fertilizer is poor, and yields normally are low. Most areas can be left in meadow an extra year or more when the surrounding soils are cultivated.

The Adair soil puddles readily and becomes compact if plowed when wet. In spring it is not uncommon for tractors to become mired in these wet areas. Interceptor tile is needed in places to drain seepy areas.

CAPABILITY UNIT IIIw-1

This unit is made up of the very poorly drained, dark-colored Wabash soil. This soil occurs in low, slightly depressed areas on bottom lands. It has a black, plastic surface layer of silty clay and a very slowly permeable, plastic, clayey subsoil. The water table is frequently high. The rate of water intake is very slow, the movement of water through the plastic subsoil is slow, and the water-holding capacity is high. Not all of the moisture held in the soil is available for plant use, because of the high content of clay. The fine-textured subsoil retards the movement of water and restricts the root development of some plants. This soil is slow to warm up in spring and cannot be worked soon after rains. It puddles readily when wet and, if worked when wet, becomes hard and cloddy in drying. Plowing is best done in fall so that freezing and thawing during winter months will improve workability. Water often ponds on the surface of this soil for several days after rains.

Tile lines do not function properly in this soil, but shallow surface drains are helpful in removing surface water. Although the use of this soil is limited because of wetness, some improved areas are used for cultivated crops. Unimproved areas generally remain in grass or are left idle. In wet years, most areas are left idle. Corn is the principal row crop, but soybeans are also grown, and wheat can be grown. The response to fertilizer is poor, and yields vary.

CAPABILITY UNIT IIIw-2

This unit consists of moderately dark colored and dark colored soils of the Chariton, Sperry, and Walford series. These soils are in nearly level or slightly depressed areas and are often ponded during wet periods or after heavy rains. They have a friable medium-textured surface layer and a firm moderately fine textured or fine textured subsoil that is slowly or very slowly permeable. The rate of water intake is slow, and the movement of air and water is restricted. Root development of some plants is limited because of the fine-textured subsoil and perched high water table. These soils are readily puddled if worked when wet. If drained, they can be worked about as soon as surrounding soils. Tile functions fairly well, but in places surface drains are needed to remove ponded water.

The soils of this unit occur in small areas and in wet years can be left idle when surrounding soils are cultivated. Although corn and soybeans are the principal crops, the rotation generally is the same as that of surrounding soils. Alfalfa and similar legumes are frequently drowned or winterkilled. The response to fertilizer varies, but in years of average or less than average rainfall, the response is good. Additions of potash are beneficial in most areas because aeration is poor. Yields vary according to the wetness of the soils.

CAPABILITY UNIT IIIs-1

In this unit are moderately sloping, well-drained to excessively drained soils of the Chelsea, Dickinson, Fayette, Hagener, Lamont, and Tama series. These soils have a friable, medium-textured to coarse-textured surface layer. The subsoil is medium textured or moderately fine textured in the Fayette and Tama soils, moderately coarse textured in the Dickinson and Lamont soils, and coarse textured in the Hagener and Chelsea soils. The Chelsea, Dickinson, and Hagener soils have low moisture-holding capacity and are rapidly permeable. Surface runoff is slow on all of the soils in this unit except the Tama and Fayette, and the rate of water intake is good. However, most of the moisture received is lost through deep percolation. These soils are quick to warm up in spring and can be worked soon after rains. The sandier soils are susceptible to both wind and water erosion if left unprotected, particularly in spring. Crop residues left on the surface help to reduce soil loss.

For crops, all of these soils are limited to some extent by droughtiness, but the Fayette and Tama soils are less severely limited than the other soils in this unit. In most areas, conservation practices are difficult to apply because of the complex slopes. The sandy soils are difficult to terrace, and the soils as a whole are better suited to stripcropping than to terracing. If fields are stripcropped, corn can be grown 2 years in 5. Soils that are used for meadow for 3 years or more may be damaged by rodent activity. Wind erosion of sandy spots can be reduced by keeping crop residues or barnyard manure on the surface. Lime and fertilizer are needed for best yields of corn, oats, and hay.

CAPABILITY UNIT IIIs-2

In this unit are moderately sloping, medium-textured soils of the Tell and Waukegan series. These soils have a friable, medium-textured surface layer and a friable, medium-textured or moderately fine textured subsoil. A coarse-textured substratum is between a depth of 24 and 40 inches in the Tell soils and between a depth of 24 and 45 inches in the Waukegan soils. Permeability is medium in the subsoil but rapid in the substratum. The movement of air and water through the soil is good, and the rate of water intake is good, but there is some runoff because of the slope. The Tell soils are low in organic-matter content and tend to crust after hard rains. All of the soils in this unit are easily tilled, warm up quickly in spring, and can be worked soon after rains. However, the water-holding capacity is moderate, and in some years crops are damaged because of the lack of moisture.

These soils are droughty and are susceptible to erosion. They are moderately well suited to cultivated crops and are used mainly for row crops, hay, and pasture. Root growth is restricted to some extent by the underlying sand. To reduce soil and water losses, many areas can be terraced, but cuts need to be kept to a minimum so as not to expose the coarse-textured substratum. If fields are terraced, corn can be grown for 3 years in 5 on the Waukegan soils, and for 2 years in 5 on the Tell soils. Yields are favorable in years of normal rainfall or when rainfall is evenly distributed throughout the growing season. Nevertheless, yields may vary from one area to another because of the variation in depth to the sandy material. If rainfall is adequate, the response to fertilizer is good. During periods of low rainfall, crops respond to irrigation, but large amounts of fertilizer are needed to make irrigation profitable.

CAPABILITY UNIT IIIs-3

This unit consists of nearly level and gently sloping, excessively drained Dickinson, Hagener, and Tama soils. The Dickinson and Hagener soils have a friable, moderately coarse textured or coarse textured surface layer and a moderately coarse textured or coarse textured subsoil. The Tama soils have a medium-textured surface layer and a moderately fine textured subsoil. The soils in this unit absorb rainfall readily but hold little for plant use. They warm up early in spring and can be worked soon after rains.

Droughtiness is the principal limitation on these soils. Water erosion is not a serious hazard, but wind erosion may damage young crops. Crop residues or barnyard manure, kept on the surface, helps to control soil blowing. If the surface is dry and bare in spring, disking in strips crosswise to the direction of the wind gives some protection against wind erosion.

The soils of this unit are used principally for corn, oats, hay, and pasture. Yields depend largely on the timeliness of rainfall but generally are only fair. Crops do not respond well to large amounts of fertilizer, because the moisture-holding capacity of the soils is low. During periods of low rainfall, the response to irrigation is good, but larger amounts of fertilizer are needed to make irrigation profitable.

CAPABILITY UNIT IVe-1

In this unit are deep, moderately steep, dark colored and moderately dark colored soils of the Bassett, Downs, Gara, Ladoga, Otley, Shelby, and Tama series. These soils have a friable, medium-textured surface layer and a medium-textured or moderately fine textured subsoil. The subsoil is moderately permeable in the Tama and Downs soils, and moderately slowly permeable in the other soils. The movement of air and water through all of the soils is good, the moisure-holding capacity is high, and the organic-matter content is low. These soils are easy to till, although tilth is somewhat poor in moderately eroded areas. Erosion is a serious hazard because runoff is rapid and the soils are highly erodible.

Although most of the acreage has been used for row crops, these soils are best suited to hay and pasture because of the serious erosion hazard. They are too steep for terracing and are subject to serious soil loss if only contour tillage is used. Thus, they need to be stripcropped if corn is grown. A rotation that includes corn only once in 5 years can be used, but as a rule row crops should be grown only when hay and pasture need reseeding. Soybeans are not suitable. In places there are gullies that need to be shaped and seeded. In some areas diversion terraces, placed at the base of slopes, will help to protect soils downslope from runoff. Lime and phosphate generally are required to establish legumes and grass.

CAPABILITY UNIT IVe-2

This unit consists of deep, moderately steep, light-colored Clinton, Fayette, and Hopper soils on uplands. These soils differ from the soils in unit IVe-1 in that they are lighter colored and are lower in organic-matter content. The surface layer is friable silt loam. The subsoil is moderately fine textured in the Clinton and Fayette soils and medium textured in the Hopper soil. The movement of air and water through the soils is good, and the water-holding capacity is high. Because of their somewhat poorly granulated surface layer and moderately steep slopes, these soils are susceptible to severe erosion. The surface tends to seal during hard rains and to form a crust when dry. Crusting is less noticeable in the Hopper soil than in the other soils in this unit.

These soils are suited to hay and pasture. Corn and oats ordinarily are not suitable, except to reestablish grasses and legumes. Slopes are too steep for terracing. Therefore, fields that are used for corn need to be stripcropped or tilled on the contour. Soybeans should not be substituted for corn in the rotation. The seeding of waterways helps to prevent the formation of gullies. Favorable yields can be obtained if these soils are protected from erosion and are adequately fertilized. Lime generally is needed to establish legumes on the Clinton and Fayette soils. The Hopper soils ordinarily have an excess amount of lime in the subsoil. Some small isolated areas that are difficult to farm occur within areas of these soils. These small areas provide good habitats for wildlife.

CAPABILITY UNIT IVe-3

In this unit are strongly sloping, moderately slowly permeable and slowly permeable Adair, Keswick, and Lindley soils. These soils have a friable, medium-textured surface layer and a firm, clayey, moderately slowly permeable or slowly permeable subsoil. Although they are moderately well drained, the Adair and Keswick are seasonally wet because of seepage from more permeable soils upslope. Cultivated areas are susceptible to erosion because the rate of water intake is slow and runoff is rapid.

The Adair and Keswick soils commonly occur as narrow bands or as small areas within larger, more productive areas that are used for row crops. These small areas are best left in grass when surrounding soils are cultivated. Terraces are not desirable on these soils because the fine textured subsoil would be exposed in the terrace channels.

The soils in this unit are best suited to oats, hay, and pasture. They are not well suited to row crops but can be used for corn when hay and pasture need reseeding. Seedings are difficult to establish, particularly on the Adair and Keswick soils, because tilth is poor and fertility is low. The response to fertilizer is poor, but phosphate and lime generally are needed to establish legumes. Control of grazing is important. These soils provide suitable sites for ponds that supply water for livestock.

CAPABILITY UNIT IVe-4

This unit consists of severely eroded, strongly sloping, light-colored to dark-colored soils of the Bassett, Clinton, Downs, Fayette, Gara, Ladoga, Otley, Shelby, and Tama series. These soils have a friable, medium-textured or moderately fine textured surface layer and a moderately fine textured subsoil. Premeability is moderate or moderately slow, the water-holding capacity generally is high, and the organic-matter content is low. The soils in this unit have poorer tilth than similar soils that are less eroded, and they are more difficult to work. The surface tends to seal during rains and to form a crust when dry. Because of this and the strong slopes, the rate of water intake is somewhat restricted, and runoff is high. The Bassett, Gara, and Shelby soils, which were derived from glacial till, are less productive than the other soils in this unit. In addition, numerous small rocks occur on their surface and interfere to some extent with tillage.

The soils of this unit are best suited to hay, pasture, or trees. In many places they are closely associated with more productive soils and are difficult to manage separately. These areas are best left in meadow when the adjacent soils are cultivated. Barnyard manure is beneficial in establishing a stand of grasses and legumes in these areas. The response to fertilizer is less on the soils in this unit than on similar soils that are less eroded, and yields of corn generally are low. These soils are low in nitrogen, and they also need lime if legumes are grown.

CAPABILITY UNIT IVe-5

This unit consists of strongly sloping, well-drained to excessively drained soils of the Chelsea, Fayette, Hagener, Lamont, Tama, and Tell series. These soils have a very friable, medium-textured or moderately coarse textured surface layer. All of these soils, except the Fayette and Tama, grade to coarse-textured material with depth. They vary in water-holding capacity and in permeability. The rate of water intake is good, but some moisture is lost through deep percolation. Because of the strong slopes, runoff is moderate. The soils in this unit are easily tilled. They warm up quickly in spring and can be worked soon after rains. The Chelsea and Hagener soils are readily eroded by wind if the surface is left barren or if vegetation is sparse. In some places young crops are damaged by blowing sand.

These soils are not well suited to cultivated crops because they are droughty and are susceptible to erosion. Nevertheless, part of the acreage is cultivated. Some is pastured or wooded. Even in years of average rainfall, crops may be damaged because of insufficient moisture. Because most slopes are short and irregular, stripcropping is the most effective erosion control practice. Terracing generally is not suitable, particularly on the sandy soils. Crop residues, left on the surface, help to control both wind and water erosion. Rodents frequently do considerable damage to fields that are left in grasses and legumes for 3 years or more. Yields of crops commonly are low or moderate but depend largely on the amount and timeliness of rains. Both lime and fertilizer are needed for best yields of corn, oats, and hay. Lime generally is needed to establish legumes. Trees of suitable species grow well.

CAPABILITY UNIT IVs-1

This unit consists of deep, excessively drained, nearly level or moderately sloping Chelsea and Hagener soils. These soils have a loose or very friable, moderately coarse textured or coarse textured surface layer and subsoil and are shallow over coarse textured material. They warm up quickly in spring and can be worked very soon after rains. However, they are rapidly permeable, very low in moisture-holding capacity, and moderately low or low in organic-matter content. They absorb moisture readily, but lose much of this moisture through deep percolation. Consequently, in years of average rainfall, soil moisture is not sufficient to grow a good crop. Sheet erosion generally is not a problem, but wind erosion is a hazard if the surface is barren or the vegetation sparse.

Only part of the acreage is cultivated. Some areas are in pasture. These soils are of limited use for crops because they are droughty and are susceptible to wind erosion. Erosion is a more serious hazard on the Chelsea soil than on the Hagener. Blowing sand may damage new seedings not only on these soils but also on adjacent soils. In spring, when the soils are barren and dry, wind erosion can be reduced by disking in strips crosswise to the direction of the wind. Leaving crop residues on the surface also helps to control soil blowing. Because manure and other residues decompose rapidly, practices to increase the organic-matter content are not practical. Yields depend on the fertility of the soils and on the timeliness of rainfall during the growing season, but ordinarily are moderate or low, even if management is good. Pastures need to be reseeded frequently. If left in meadow 3 years or longer, fields may be seriously damaged by rodent activity. Lime and commercial fertilizer need to be applied in smaller amounts and more often on these soils than on the soils in other units.

CAPABILITY UNIT Vw-1

This unit is made up of level, mixed silty and sandy soils of the Amana, Lawson, and Nodaway series and of Alluvial land. These soils are severely dissected by old stream channels and are frequently overflowed. Alluvial land is sandy and droughty in some places and is poorly drained in others.

The soils of this unit are mostly timbered or are under a cover of scattered trees and grass. They are best suited to trees, although open areas can be used for pasture. Alluvial land is less desirable for pasture than the other soils because the vegetation is mainly sedges, marshgrass, and shrubs. On the other soils, there are some good stands of bluegrass. Some areas of the Amana, Lawson, and Nodaway soils are productive, but these areas generally require land leveling and protection from flooding before they can be used for crops. In years when the frequency of flooding is less than normal, some small areas are used for crops. Yields in these areas are above average. Without major reclamation, the soils of this unit are best suited to pasture, woods, or wildlife habitats.

CAPABILITY UNIT VIe-1

In this unit are moderately steep soils of the Bassett, Clinton, Downs, Fayette, Gara, Hopper, Ladoga, and Shelby series. These soils occur on uplands that are severely eroded. Except for the Hopper soil, which is medium-textured, all of the soils have a moderately fine tex-

tured surface layer and subsoil. Permeability is moderate or moderately slow, the water-holding capacity is high, and the organic-matter content is low. The surface may seal during hard rains. Consequently, runoff generally is high, and the hazard of further erosion is serious. Small rocks, large enough to interfere with tillage, occur in places on the surface of the Gara, Bassett, and Shelby soils. Because of poor workability and tilth, the soils of this unit are often referred to locally as the "clay soils."

Although most of the acreage has been used for cultivated crops, these severely eroded soils are gradually being seeded to permanent pasture. Some small areas that occur within larger areas of more productive soils can be left in meadow when adjoining soils are cultivated. These areas should be plowed only when the meadow needs reseeding. Waterways and gullies can be shaped and seeded. Diversion terraces, constructed on these soils, help to protect soils downslope from runoff and siltation.

All of these soils, except the Hopper, are acid unless limed. They need lime if legumes are grown. Scattered outcrops on the Hopper soil contain an excessive amount of lime. The Fayette and Clinton soils normally are high in phosphorus. The response to fertilizer generally is variable.

CAPABILITY UNIT VIe-2

This unit consists of dark-colored and light-colored, moderately steep and steep soils of the Bassett, Chelsea, Clinton, Fayette, Gara, Hagener, Hopper, Lamont, Shelby, and Tama series. Most of these soils have a friable, medium-textured surface layer and a moderately fine textured subsoil. The Chelsea and Lamont soils are coarse textured, and the Hopper soils are medium textured. All of the soils are high in water-holding capacity, except the Chelsea and Lamont, which are low. The amount of moisture absorbed is low because runoff is rapid. These soils are readily eroded by runoff if the surface is barren or if vegetation is sparse. In many places they are moderately or severely eroded, and in some places gullies have formed. In the eroded areas, tilth is poor. Unless protected by vegetation or crop residues, the surface tends to seal during hard rains. The operation of farm machinery is difficult on these soils because of the steepness of the slope and the presence of gullies and waterways.

These soils are not suited to cultivated crops and are only moderately well suited to pasture. Crops that require tillage should be grown only to reestablish meadow. Small areas that occur within larger areas of more productive soils are best left in permanent cover when the surrounding soils are cultivated. Control of grazing is necessary in most places to prevent serious damage to the vegetation. Wooded areas need to be protected from grazing. Some areas can be planted to trees. Small areas provide good habitats for wildlife. Diversion terraces, constructed in places, will help to protect soils downslope from runoff.

Large applications of fertilizer generally are not profitable on these soils, but lime commonly is needed if legumes are grown.

CAPABILITY UNIT VIe-3

In this unit are strongly sloping and moderately steep, slowly permeable soils of the Adair, Keswick, and Lindley series. These soils have a medium-textured or moderately fine textured surface layer and a firm clayey subsoil that is slowly permeable or moderately slowly permeable. Although all of the soils are moderately well drained, the Adair and Keswick soils are seasonally wet because of seepage from more permeable soils upslope. Runoff is rapid, and soil losses are high in cultivated fields. In places there are deep waterways and gullies that interfere with the use of farm machinery. Small stones occur on the surface in some places. The range of moisture content within which these soils can be worked is very narrow. Consequently, the preparation of good seedbeds is often difficult. Generally, more power is needed to plow these soils than to plow adjacent soils.

These soils are not suited to cultivated crops, but they can be used for permanent pasture. In places they occur as narrow bands within larger areas of more productive soils. If it is not feasible to separate and manage these bands separately, they can be left in grass when the surrounding soils are cultivated. Some areas can be used for hay; others provide good habitats for wildlife. In places the Lindley and Keswick soils can be planted to trees. The soils in this unit are not productive and should be used for crops that require tillage only when pastures need to be reestablished. Barnyard manure is beneficial in these areas to help establish seedings, but generally the response to fertilizer is poor. Lime is needed in most places if legumes are grown. These soils provide good sites for construction of ponds that supply water for livestock.

CAPABILITY UNIT VIs-1

This unit consists only of the strongly sloping, excessively drained Hagener soil. This soil has a very friable or loose, coarse-textured surface layer and is underlain by sand. It is rapidly permeable, low in organic-matter content, and very low in moisture-holding capacity. Although the rate of water intake is high, most of the moisture is lost through deep percolation. This soil warms up quickly in spring and can be worked soon after rains, but it is highly erodible if left barren and unprotected. Blowout spots occur in some places.

This soil cannot store enough moisture for good plant growth. Thus, it is not suited to cultivated crops. The response to fertilizer is poor, and heavy applications generally are not profitable. Rodent activity often becomes serious in fields that are kept in meadow for 3 years or more. Trees of suitable species grow reasonably well in places, and small areas that are left idle provide good habitats for wildlife.

CAPABILITY UNIT VIIe-1

This unit consists of steep and moderately steep soils of the Adair, Gara, Keswick, and Lindley series. These soils are mostly severely or moderately eroded. They were derived from glacial till and have a medium-textured or moderately fine textured surface layer and a firm, clayey subsoil that is moderately slowly permeable to very slowly permeable. The rate of water intake is slow, and runoff is rapid. The organic-matter content is low, tilth is poor, and the range of moisture content within which these soils can be worked is narrow. Consequently, seedbeds are dif-

ficult to prepare. In places there are deep gullies and waterways that interfere with the use of farm machinery. Small stones occur on the surface in some areas.

These soils can be used for pasture or trees. In places the Adair soils occur as narrow bands and are closely associated with more productive soils. These areas are best left in permanent vegetation when the adjoining soils are cultivated. They make good habitats for wildlife. Yields of forage crops are low on the soils in this unit, and grazing needs to be controlled to insure a permanent cover of vegetation. Although some areas can be planted to trees, many areas are difficult to renovate because of the steep slopes. Large applications of fertilizer generally are not practical, but lime commonly is needed if legumes are grown. These soils provide suitable sites for the construction of ponds that supply water for livestock.

CAPABILITY UNIT VIIe-2

This unit consists of sloping to steep Gullied land. This land is associated mainly with the Adair, Keswick, and Lindley soils. It is so severely gullied that, without major reclamation, it is not suitable for either crops or pasture. The gullies are too large to be crossed with farm machinery, and in many places they subdivide fields into units too small to be farmed efficiently. Diversions constructed around the top of the drainage system will prevent some gullies from becoming larger and more active.

Although trees can be planted on Gullied land, only limited success can be expected in establishing stands. In some areas the gullies can be filled and seeded to permanent grass. These renovated areas generally need to be fenced to protect them from grazing. The response to fertilizer is poor, but manure and fertilizer commonly are needed to establish a cover of vegetation. This land provides excellent habitats for wildlife.

CAPABILITY UNIT VIIe-3

In this unit are well-drained to excessively drained Chelsea, Fayette, Lamont, and Lindley soils that occupy many of the steep, very irregular areas of the county. With the exception of the Chelsea and Lamont soils, these soils have high moisture-holding capacity. Much of the rain that falls, however, runs off the steep slopes. If not protected, these soils are susceptible to severe erosion. Most areas are too steep to be renovated with regular farm machinery, and waterways and gullies are common. Some areas of the Chelsea, Fayette, and Lamont soils are subject to wind erosion if left barren or if the vegetation is sparse.

Where these soils are wooded, they are not eroded. Although some open areas are of limited use for pasture early in summer, the carrying capacity of pastures is low, and grazing needs to be carefully controlled to insure a permanent cover of vegetation.

If these soils are used for woods, they need to be fenced to prevent their being grazed. Stands of timber can be improved by removing undesirable trees, diseased trees, or poorly formed trees and by protecting young trees and seedlings. As the trees mature, they should be harvested with the same care that is used in harvesting other crops. These soils provide excellent habitats for wildlife and are suitable as sites for ponds that provide water for livestock.

CAPABILITY UNIT VIIs-1

This unit consists of light-colored and dark-colored, strongly sloping or steep Chelsea and Hagener soils. These soils are coarse textured and are extremely droughty and erodible. They are rapidly permeable and have low moisture-holding capacity. Fertility generally is low.

The soils of this unit have low value as permanent pasture. Most areas are small and generally are left idle or are farmed with adjoining soils. A few areas are wooded, but most of these areas need improvement. The renovation of pastures is difficult on these soils because slopes are too steep for the use of regular farm machinery. Sand lovegrass is the most suitable grass in areas that are to be reseeded. A mulch of strawy barnyard manure will help new seedings to become established. The carrying capacity of pastures is low, however, and grazing needs to be controlled to insure a permanent cover of vegetation. The response to fertilizer is poor, and large applications ordinarily are not profitable.

Estimated Yields

Table 2 gives the estimated yields of the principal crops grown in the county under a high level of management. It is assumed that this level of management has been used for at least 10 years, so that the yields reflect the effect of good management practices. A high level of management includes the following:

1. Draining wet soils adequately with tile or surface drainage.
2. Using suitable varieties of crops.
3. Controlling weeds, plant diseases, and insects effectively.
4. Controlling erosion.
5. Planting the amount of seed that will produce a plant population no greater than the available moisture will support.
6. Applying fertilizer and lime in kinds and amounts indicated by soil tests so that the soil reaches the levels of fertilization and reaction approaching those suggested by the soil testing laboratory of the Iowa State University.
7. Cultivating and harvesting at the proper time.
8. Planting alfalfa and bromegrass or orchardgrass for hay on suitable soils, to obtain three cuttings a year.

The estimated yields in table 2 are considered to be fairly reliable appraisals of what can be harvested if normal methods of good management are followed. The figures are based on research data from the Corn Yield Study (Project 1377) of the Iowa State University Agricultural Experiment Station, and on estimates made by soil scientists of the Soil Conservation Service. Yields fluctuate from year to year. Some farmers who use the best techniques and management known today may increase yields in the future by the use of new crop varieties, by better fertilization practices, or by other improved methods.

The section "Management of Woodland" shows the annual production of hardwoods, in board feet per acre, on soils that are used for timber.

TABLE 2.—*Management*

[Dashed line indicates that the crop is not

Map symbol	Soil	Capability unit	Management problems
AaC2	Adair clay loam, 5 to 9 percent slopes, moderately eroded	IIIe-5	Sheet erosion; seepy, tight subsoil; poor tilth.
AaD2	Adair clay loam, 9 to 14 percent slopes, moderately eroded	IVe-3	Sheet erosion; seepy, tight subsoil; poor tilth.
AaE2	Adair clay loam, 14 to 18 percent slopes, moderately eroded	VIe-3	Sheet erosion; tight subsoil; poor tilth.
AcD2	Adair clay loam, thin solum, 9 to 14 percent slopes, moderately eroded.	IVe-3	Sheet erosion; poor tilth; low inherent fertility.
AcE2	Adair clay loam, thin solum, 14 to 18 percent slopes, moderately eroded.	VIe-3	Sheet erosion; poor tilth; low inherent fertility.
AdD3	Adair soils, 9 to 14 percent slopes, severely eroded	VIe-3	Sheet erosion; seepy, tight subsoil; poor tilth.
AdE3	Adair soils, 14 to 18 percent slopes, severely eroded	VIIe-1	Sheet erosion; tight subsoil; poor tilth.
AeD3	Adair soils, thin solum, 9 to 14 percent slopes, severely eroded.	VIe-3	Sheet erosion; poor tilth; low inherent fertility.
AeE3	Adair soils, thin solum, 14 to 18 percent slopes, severely eroded.	VIIe-1	Sheet erosion; poor tilth; low inherent fertility.
AeF3	Adair soils, thin solum, 18 to 25 percent slopes, severely eroded.	VIIe-1	Sheet erosion; poor tilth; low inherent fertility.
Al	Alluvial land	Vw-1	Frequent overflow; old channels and bayous; ponding.
Am	Amana silt loam	I-2	Slight wetness; overflow.
An	Amana-Lawson-Nodaway complex	Vw-1	Occasional overflow; old channels and bayous.
As	Atterberry silt loam	I-1	Slight wetness.
At	Atterberry silt loam, benches	I-1	Slight wetness.
BaC2	Bassett loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.
BaD2	Bassett loam, 9 to 14 percent slopes, moderately eroded	IIIe-3	Sheet erosion.
BaE2	Bassett loam, 14 to 18 percent slopes, moderately eroded	IVe-1	Sheet erosion.
BaF2	Bassett loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet erosion.
BeD3	Bassett soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; low fertility; poor tilth.
BeE3	Bassett soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; poor tilth; low fertility.
BrA	Bertrand silt loam, 0 to 2 percent slopes	I-1	Fertility maintenance.

See footnotes at end of table.

and yield data for soils

suited to the soil or is not generally grown on it]

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
Long-term meadow [2]	None				1. 6	80
R–O–M–M–M [3]	Contouring	50		40	1. 6	80
Long-term meadow	None				1. 4	70
Permanent pasture [4]	(5)				1. 0	50
Long-term meadow	None				1. 6	80
Long-term meadow	Contouring				1. 6	80
R–O–M–M–M	Stripcropping	48		37	1. 6	80
Permanent pasture [4]	(5)				1. 2	60
Permanent pasture [4]	(5)				1. 2	60
Permanent pasture [4]	(5)				. 8	40
Permanent pasture [4]	(5)				1. 4	70
Permanent pasture [4]	(5)				1. 0	50
Permanent pasture [4]	(5)					40
Permanent pasture [4]	(5)				1. 5	75
Intensive row cropping [6]	None	[7] 85	[7] 35	[7] 60	3. 0	150
Permanent pasture	None				2. 0	100
Corn or beans where practical	None	(7)	(7)			
Intensive row cropping	None	90	35	67	3. 6	180
Intensive row cropping	None	90	35	67	3. 6	180
R–O–M–M	None	75	25	56	3. 0	150
R–R–R–O–M	Terracing	75	25	56	3. 0	150
R–R–O–M–M	Contouring	75	25	56	3. 0	150
Long-term meadow	None				2. 8	140
R–O–M–M	Terracing	70		52	2. 8	140
R–R–O–M–M–M or R–O–M–M	Contouring	70		52	2. 8	140
R–O–M–M	Stripcropping	70		52	2. 8	140
Long-term meadow	None				2. 2	110
Long-term meadow	Contouring				2. 2	110
R–O–M–M–M	Stripcropping	55		40	2. 2	110
Permanent pasture [4]	(5)				1. 4	70
Long-term meadow	None				2. 5	125
R–O–M–M–M	Contouring	62		47	2. 5	125
R–O–M–M	Stripcropping	62		47	2. 5	125
Permanent pasture [4]	(5)				1. 8	90
R–R–R–O–M	None	88	31	66	3. 5	175

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
BrB	Bertrand silt loam, 2 to 5 percent slopes	IIe–2	Sheet erosion.
BrC2	Bertrand silt loam, 5 to 9 percent slopes, moderately eroded	IIIe–2	Sheet erosion.
Bs	Bremer silty clay loam	IIw–2	Moderate wetness.
Bt	Bremer silt loam, overwash	IIw–2	Wetness; siltation.
Ca	Chariton silt loam	IIIw–2	Wetness; ponding water.
CeB	Chelsea fine sand, 2 to 9 percent slopes	IVs–1	Severe droughtiness; wind and water erosion.
CeD	Chelsea fine sand, 9 to 18 percent slopes	VIIs–1	Severe droughtiness; wind and gully erosion.
CeG	Chelsea fine sand, 18 to 40 percent slopes	VIIs–1	Severe droughtiness; wind and gully erosion.
CfC	Chelsea-Fayette-Lamont complex, 5 to 9 percent slopes	IIIs–1	Moderate droughtiness; sheet and gully erosion.
CfD	Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes	IVe–5	Moderate droughtiness; sheet and gully erosion.
CfD2	Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes, moderately eroded.	IVe–5	Moderate droughtiness; sheet and gully erosion.
CfE	Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes	VIe–2	Sheet erosion; moderate droughtiness.
CfE2	Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes, moderately eroded.	VIe–2	Sheet erosion; moderate droughtiness.
CfG	Chelsea-Fayette-Lamont complex, 18 to 40 percent slopes	VIIe–3	Sheet erosion; moderate droughtiness.
ClB	Clinton silt loam, 2 to 5 percent slopes	IIe–2	Sheet erosion.
ClC	Clinton silt loam, 5 to 9 percent slopes	IIIe–2	Sheet erosion.
ClC2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded	IIIe–2	Sheet erosion.
ClD	Clinton silt loam, 9 to 14 percent slopes	IIIe–4	Sheet erosion.
ClD2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded	IIIe–4	Sheet erosion.
ClE2	Clinton silt loam, 14 to 18 percent slopes, moderately eroded	IVe–2	Sheet erosion.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
R–R–O–M–M	None	85	30	64	3.4	170
R–R–R–O–M or R–R–R–Ox [3]	Terracing	85	30	64	3.4	170
R–R–R–O–M	Contouring	85	30	64	3.4	170
R–O–M–M–M	None	80	25	60	3.2	160
R–R–R–O–M	Terracing	80	25	60	3.2	160
R–R–O–M–M–M	Contouring	80	25	60	3.2	160
R–R–O–M–M or R–R–O–M–M–M	Stripcropping	80	25	60	3.2	160
Intensive row cropping	None	85	40	65	3.4	170
Intensive row cropping	None	80	32	60	3.0	150
Intensive row cropping	None	[7] 70	[7] 25	[7] 45	[7] 2.0	[7] 100
R–O–M–M	None	45	15	33	1.8	90
R–O–M–M	Contouring	45	15	33	1.8	90
R–O–M–M	Stripcropping	45	15	33	1.8	90
Permanent pasture [4]	([5])				1.2	60
Permanent pasture [4]	([5])				.5	25
R–O–M–M–M	None	45	15	33	1.8	90
R–R–O–M–M–M	Contouring	45	15	33	1.8	90
R–R–O–M–M or R–R–O–M–M–M	Stripcropping	45	15	33	1.8	90
Long-term meadow	None				1.6	80
Long-term meadow	Contouring				1.6	80
R–O–M–M	Stripcropping	40		30	1.6	80
Long-term meadow	None				1.4	70
Long-term meadow	Contouring				1.4	70
R–O–M–M	Stripcropping	38		28	1.4	70
Permanent pasture [4]	([5])				1.0	50
Permanent pasture [4]	([5])				1.0	50
Permanent pasture [4]	([5])				.6	30
R–R–O–M–M	None	80	25	60	3.2	160
R–R–R–O–M or R–R–R–Ox	Terracing	80	25	60	3.2	160
R–R–R–O–M	Contouring	80	25	60	3.2	160
R–O–M–M–M	None	77	23	57	3.1	155
R–R–O–M	Terracing	77	23	57	3.1	155
R–O–M–M	Contouring	77	23	57	3.1	155
R–R–O–M–M	Stripcropping	77	23	57	3.1	155
R–O–M–M–M	None	75	22	56	3.0	150
R–R–O–M	Terracing	75	22	56	3.0	150
R–O–M–M	Contouring	75	22	56	3.0	150
R–R–O–M–M	Stripcropping	75	22	56	3.0	150
Long-term meadow	None				2.9	145
R–O–M–M	Terracing	72	20	54	2.9	145
R–O–M–M–M	Contouring	72	20	54	2.9	145
R–O–M–M or R–R–O–M–M–M	Stripcropping	72	20	54	2.9	145
Long-term meadow	None				2.8	140
R–O–M–M	Terracing	70	20	52	2.8	140
R–O–M–M–M	Contouring	70	20	52	2.8	140
R–O–M–M	Stripcropping	70	20	52	2.8	140
Long-term meadow	None				2.2	110
Long-term meadow	Contouring				2.2	110
R–O–M–M–M	Stripcropping	55		40	2.2	110

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
ClF2	Clinton silt loam, 18 to 25 percent slopes, moderately eroded	VIe–2	Sheet erosion.
CnD3	Clinton soils, 9 to 14 percent slopes, severely eroded	IVe–4	Sheet erosion; poor tilth; low fertility.
CnE3	Clinton soils, 14 to 18 percent slopes, severely eroded	VIe–1	Sheet erosion; poor tilth; low fertility.
Co	Colo silty clay loam	IIw–2	Wetness; occasional flooding.
Cs	Colo silt loam, overwash	IIw–2	Wetness; moderate flooding.
Ct	Colo-Ely complex, 1 to 5 percent slopes	IIw–1	Wetness; local flooding; gullies.
Cu	Coppock silt loam	IIw–1	Wetness; local flooding.
DcA	Dickinson sandy loam, 0 to 2 percent slopes	IIIs–3	Droughtiness; wind erosion.
DcB	Dickinson sandy loam, 2 to 5 percent slopes	IIIs–3	Droughtiness; wind and water erosion.
DcC	Dickinson sandy loam, 5 to 9 percent slopes	IIIs–1	Droughtiness; sheet erosion.
DbB	Dinsdale silty clay loam, 2 to 5 percent slopes	IIe–1	Sheet erosion.
DdC	Dinsdale silty clay loam, 5 to 9 percent slopes	IIIe–1	Sheet erosion.
DoB	Downs silt loam, 2 to 5 percent slopes	IIe–1	Sheet erosion.
DoC	Downs silt loam, 5 to 9 percent slopes	IIIe–1	Sheet erosion.
DoC2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	IIIe–1	Sheet erosion.
DoD2	Downs silt loam, 9 to 14 percent slopes, moderately eroded	IIIe–3	Sheet erosion.
DoE2	Downs silt loam, 14 to 18 percent slopes, moderately eroded	IVe–1	Sheet erosion.
DpB	Downs silt loam, benches, 2 to 5 percent slopes	IIe–1	Sheet erosion.
DsD3	Downs soils, 9 to 14 percent slopes, severely eroded	IVe–4	Sheet erosion; poor tilth; low fertility.
DsE3	Downs soils, 14 to 18 percent slopes, severely eroded	VIe–1	Sheet erosion; poor tilth; low fertility.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
Permanent pasture [4]	(5)				1.8	90
Long-term meadow	None				2.4	120
Long-term meadow	Contouring				2.4	120
R-O-M-M-M	Terracing	60		45	2.4	120
R-O-M-M-M	Stripcropping	60		45	2.4	120
Permanent pasture [4]	(5)				2.0	110
Intensive row cropping	None	85	35	64	3.4	170
Intensive row cropping	None	88	35	66	3.5	175
Intensive row cropping	None	85	35	64	3.4	170
Intensive row cropping	None	70	28	50	2.8	140
R-R-Ox or R-R-O-M	None	65	23	48	2.6	130
R-O-M	None	60	20	45	2.4	120
R-R-R-O-M	Terracing	60	20	45	2.4	120
R-R-O-M	Contouring	60	20	45	2.4	120
R-O-M-M-M	None	50	18	40	2.0	100
R-R-O-M	Terracing	50	18	40	2.0	100
R-O-M	Contouring	50	18	40	2.0	100
R-R-O-M-M	None	95	35	72	3.8	190
Intensive row cropping	Terracing	95	35	72	3.8	190
R-R-R-O-M	Contouring	95	35	72	3.8	190
R-O-M-M	None	90	30	67	3.6	180
R-R-R-O-M	Terracing	90	30	67	3.6	180
R-R-O-M-M	Contouring	90	30	67	3.6	180
R-R-O-M	None	95	35	72	3.8	190
Intensive row cropping	Terracing	95	35	72	3.8	190
R-R-R-O-M	Contouring	95	35	72	3.8	190
R-O-M-M	None	92	32	70	3.7	185
R-R-R-O-M	Terracing	92	32	70	3.7	185
R-R-O-M-M	Contouring	92	32	70	3.7	185
R-O-M-M	None	90	31	67	3.6	180
R-R-R-O-M	Terracing	90	31	67	3.6	180
R-R-O-M-M	Contouring	90	31	67	3.6	180
Long-term meadow	None				3.2	160
R-R-O-M-M-M	Terracing	80		60	3.2	160
R-O-M-M-M	Contouring	80		60	3.2	160
R-R-O-M-M-M or R-O-M-M	Stripcropping	80		60	3.2	160
Long-term meadow	None				2.8	140
Long-term meadow	Contouring				2.8	140
R-O-M-M-M	Stripcropping	70		52	2.8	140
R-R-O-M	None	95	35	72	3.8	190
Intensive row cropping	Terracing	95	35	72	3.8	190
R-R-R-O-M	Contouring	95	35	72	3.8	190
Long-term meadow	None				3.0	150
Long-term meadow	Contouring				3.0	150
R-O-M-M	Terracing	75		55	3.8	150
R-O-M-M	Stripcropping	75		55	3.8	150
Permanent pasture [4]	(5)				2.4	120

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
EsB	Ely silt loam, 2 to 5 percent slopes	IIw-1	Slight wetness; sheet erosion.
FaB	Fayette silt loam, 2 to 5 percent slopes	IIe-2	Sheet erosion.
FaC	Fayette silt loam, 5 to 9 percent slopes	IIIe-2	Sheet erosion.
FaC2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	IIIe-2	Sheet erosion.
FaD	Fayette silt loam, 9 to 14 percent slopes	IIIe-4	Sheet erosion.
FaD2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded	IIIe-4	Sheet erosion.
FaE	Fayette silt loam, 14 to 18 percent slopes	IVe-2	Sheet erosion.
FaE2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded	IVe-2	Sheet erosion.
FaF	Fayette silt loam, 18 to 25 percent slopes	VIe-2	Sheet erosion.
FaF2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet erosion.
FaG	Fayette silt loam, 25 to 40 percent slopes	VIIe-3	Sheet erosion.
FbB	Fayette silt loam, benches, 2 to 5 percent slopes	IIe-2	Sheet erosion.
FsD3	Fayette soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; poor tilth; low fertility.
FsE3	Fayette soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; poor tilth; low fertility.
FsF3	Fayette soils, 18 to 25 percent slopes, severely eroded	VIe-2	Sheet erosion; poor tilth; low fertility.
GaC2	Gara loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.
GaD2	Gara loam, 9 to 14 percent slopes, moderately eroded	IIIe-3	Sheet erosion.
GaE2	Gara loam, 14 to 18 percent slopes, moderately eroded	IVe-1	Sheet and gully erosion.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management: Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
R–R–O–M	None	92	35	70	3.7	185
Intensive row cropping	Terracing	92	35	70	3.7	185
R–R–O–M or R–R–R–Ox	Contouring	92	35	70	3.7	185
R–R–O–M–M	None	90	32	67	3.6	180
R–R–R–O–M or R–R–R–Ox	Terracing	90	32	67	3.6	180
R–R–R–O–M	Contouring	90	32	67	3.6	180
R–O–M–M	None	88	30	66	3.5	175
R–R–O–M	Terracing	88	30	66	3.5	175
R–R–O–M–M	Contouring	88	30	66	3.5	175
R–R–O–M–M or R–R–O–M–M–M	Stripcropping	88	30	66	3.5	175
R–O–M–M	None	85	30	64	3.4	170
R–R–O–M	Terracing	85	30	64	3.4	170
R–R–O–M–M	Contouring	85	30	64	3.4	170
R–R–O–M–M or R–R–O–M–M–M	Stripcropping	85	30	64	3.4	170
Long-term meadow	None				3.3	165
R–R–O–M–M–M	Terracing	82		61	3.3	165
R–O–M–M–M	Contouring	82		61	3.3	165
R–O–M–M	Stripcropping	82		61	3.3	165
Long-term meadow	None				3.1	155
R–R–O–M–M–M	Terracing	78		58	3.1	155
R–O–M–M–M	Contouring	78		58	3.1	155
R–O–M–M	Stripcropping	78		58	3.1	155
Long-term meadow	None				2.8	140
Long-term meadow	Contouring				2.8	140
R–O–M–M–M	Stripcropping	70		52	2.8	140
Long-term meadow	None				2.7	135
Long-term meadow	Contouring				2.7	135
R–O–M–M–M	Stripcropping	68		50	2.7	135
Permanent pasture [4]	(5)				2.0	100
Permanent pasture [4]	(5)				1.8	90
Permanent pasture [4]	(5)				1.4	70
R–R–O–M–M	None	90	32	67	3.6	180
R–R–R–O–M	Terracing	90	32	67	3.6	180
R–R–R–O–M	Contouring	90	32	67	3.6	180
Long-term meadow	None				2.8	140
Long-term meadow	Contouring				2.8	140
R–O–M–M	Terracing	70		52	2.8	140
R–O–M–M–M	Stripcropping	70		52	2.8	140
Permanent pasture [4]	(5)				2.4	120
Permanent pasture [4]	(5)				1.5	75
R–O–M–M–M	None	68	23	50	2.7	135
R–R–O–M	Terracing	68	23	50	2.7	135
R–O–M–M	Contouring	68	23	50	2.7	135
R–R–O–M–M	Stripcropping	68	23	50	2.7	135
Long-term meadow	None				2.4	120
R–O–M–M	Terracing	60		45	2.4	120
R–O–M–M–M	Contouring	60		45	2.4	120
R–O–M–M	Stripcropping	60		45	2.4	120
Long-term meadow	None				2.0	100
Long-term meadow	Contouring				2.0	100
Long-term meadow	Stripcropping				2.0	100

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
GaF2	Gara loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet and gully erosion.
GrD3	Gara soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; poor tilth; low fertility.
GrE3	Gara soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet and gully erosion; poor tilth; low fertility.
GrF3	Gara soils, 18 to 25 percent slopes, severely eroded	VIIe-1	Sheet erosion; poor tilth; low fertility.
Gs	Givin silt loam	I-1	Slight wetness.
Gu	Gullied land	VIIe-2	Severe gully erosion; very low fertility.
HaA	Hagener fine sand, 0 to 2 percent slopes	IVs-1	Droughtiness; slight wind erosion.
HaB	Hagener fine sand, 2 to 5 percent slopes	IVs-1	Droughtiness; slight wind and water erosion.
HaC	Hagener fine sand, 5 to 9 percent slopes	IVs-1	Severe droughtiness; slight wind and sheet erosion.
HaD	Hagener fine sand, 9 to 14 percent slopes	VIs-1	Severe droughtiness; slight wind and sheet erosion.
HaE	Hagener fine sand, 14 to 25 percent slopes	VIIs-1	Severe droughtiness; slight wind and severe sheet erosion.
HgB	Hagener-Tama complex, 2 to 5 percent slopes	IIIs-3	Slight droughtiness; slight wind and sheet erosion.
HgC	Hagener-Tama complex, 5 to 9 percent slopes	IIIs-1	Slight droughtiness; sheet erosion.
HgC2	Hagener-Tama complex, 5 to 9 percent slopes, moderately eroded.	IIIs-1	Slight droughtiness; sheet erosion.
HgD2	Hagener-Tama complex, 9 to 14 percent slopes, moderately eroded.	IVe-5	Slight droughtiness; sheet erosion.
HgE2	Hagener-Tama complex, 14 to 18 percent slopes, moderately eroded.	VIe-2	Slight droughtiness; sheet erosion.
HoD2	Hopper silt loam, 9 to 14 percent slopes, moderately eroded	IIIe-4	Sheet erosion.
HoE2	Hopper silt loam, 14 to 18 percent slopes, moderately eroded	IVe-2	Sheet erosion.
HoE3	Hopper silt loam, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; low fertility.
HoF2	Hopper silt loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet erosion.
Ja	Jackson silt loam	IIw-4	Slight wetness; fertility maintenance.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
Permanent pasture [4]	([5])				1.2	60
Long-term meadow	None				2.2	110
Long-term meadow	Contouring				2.2	110
R-O-M-M-M	Stripcropping	55		40	2.2	110
Permanent pasture [4]	([5])				1.6	80
Permanent pasture [4]	([5])				.8	40
Intensive row cropping	None	85	35	64	3.4	170
Permanent pasture [4]	([5])				.5	25
R-R-O-M	None	55	22	40	2.1	105
R-O-M	None	50	20	37	2.0	100
R-R-O-M	Contouring	50	20	37	2.0	100
R-O-M-M	None	45	18	33	1.8	90
R-O-M	Contouring	45	18	33	1.8	90
R-R-O-M-M	Stripcropping	45	18	33	1.8	90
R-O-M-M-M	None	40		30	1.6	80
R-O-M-M	Contouring	40		30	1.6	80
R-O-M-M	Stripcropping	40		30	1.6	80
Permanent pasture [4]	([5])				1.0	50
R-R-O-M-M	None	68	22	50	2.7	135
R-R-R-O-M	Terracing	68	22	50	2.7	135
R-R-O-M	Contouring	68	22	50	2.7	135
R-O-M-M	None	63	20	47	2.5	125
R-R-R-O-M	Terracing	63	20	47	2.5	125
R-O-M-M	Contouring	63	20	47	2.5	125
R-R-O-M-M	Stripcropping	63	20	47	2.5	125
R-O-M-M	None	60		45	2.4	120
R-R-R-O-M	Terracing	60		45	2.4	120
R-R-O-M-M	Contouring	60		45	2.4	120
R-R-O-M-M	Stripcropping	60		45	2.4	120
Long-term meadow	None				2.2	110
R-R-O-M	Terracing	55		40	2.2	110
R-O-M-M	Contouring	55		40	2.2	110
R-R-O-M-M-M or R-O-M-M	Stripcropping	55		40	2.2	110
Permanent pasture [4]	([5])				2.0	100
Long-term meadow	None				2.8	140
R-R-O-M-M	Terracing	70		52	2.8	140
R-O-M-M-M	Contouring	70		52	2.8	140
R-R-O-M-M	Stripcropping	70		52	2.8	140
Long-term meadow	None				2.6	130
Long-term meadow	Contouring				2.6	130
R-O-M-M	Stripcropping	65		48	2.6	130
Permanent pasture [4]	([5])				2.2	110
Permanent pasture [4]	([5])				2.0	100
R-R-R-O-M	None	90	30	67	3.6	180

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
JuB	Judson silt loam, 2 to 6 percent slopes	IIe-1	Sheet erosion; overflow from adjoining uplands.
KnB	Kenyon loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
KnC	Kenyon loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.
KnC2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.
KnD2	Kenyon loam, 9 to 14 percent slopes, moderately eroded	IIIe-3	Sheet erosion.
Ko	Keomah silt loam	IIw-4	Slight wetness; fertility maintenance.
KsD2	Keswick loam, 9 to 14 percent slopes, moderately eroded	IVe-3	Sheet erosion; seepy; poor tilth; low inherent fertility.
KsE2	Keswick loam, 14 to 18 percent slopes, moderately eroded	VIe-3	Sheet erosion; poor tilth; low inherent fertility.
KsF2	Keswick loam, 18 to 25 percent slopes, moderately eroded	VIIe-1	Sheet erosion; poor tilth; low inherent fertility.
KwD3	Keswick soils, 9 to 14 percent slopes, severely eroded	VIe-3	Sheet erosion; seepy; poor tilth; low inherent fertility.
KwE3	Keswick soils, 14 to 18 percent slopes, severely eroded	VIIe-1	Sheet erosion; poor tilth; low inherent fertility.
KwF3	Keswick soils, 18 to 25 percent slopes, severely eroded	VIIe-1	Sheet erosion; poor tilth; low inherent fertility.
Kz	Koszta silt loam	I-1	Slight wetness.
LaB	Ladoga silt loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
LaC	Ladoga silt loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.
LaC2	Ladoga silt loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.
LaD	Ladoga silt loam, 9 to 14 percent slopes	IIIe-3	Sheet erosion.
LaD2	Ladoga silt loam, 9 to 14 percent slopes, moderately eroded	IIIe-3	Sheet erosion.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
R-R-O-M	None	90	32	67	3.6	180
Intensive row cropping	Terracing	90	32	67	3.6	180
R-R-R-O-M	Contouring	90	32	67	3.6	180
R-R-O-M	None	90	32	67	3.6	180
Intensive row cropping	Terracing	90	32	67	3.6	180
R-R-R-O-M	Contouring	90	32	67	3.6	180
R-O-M-M	None	85	30	64	3.4	170
R-R-R-O-M	Terracing	85	30	64	3.4	170
R-R-O-M-M	Contouring	85	30	64	3.4	170
R-O-M-M	None	83	28	62	3.3	165
R-R-R-O-M	Terracing	83	28	62	3.3	165
R-R-O-M-M	Contouring	83	28	62	3.3	165
Long-term meadow	None				3.0	150
R-R-O-M-M	Terracing	75		55	3.0	150
R-O-M-M-M	Contouring	75		55	3.0	150
R-O-M-M	Stripcropping	75		55	3.0	150
R-R-R-O-M	None	80	28	60	3.2	160
Permanent pasture [4]	([5])				1.6	80
Permanent pasture [4]	([5])				1.2	60
Permanent pasture [4]	([5])				.8	40
Permanent pasture [4]	([5])				1.0	50
Permanent pasture [4]	([5])				.6	30
Permanent pasture [4]	([5])				.5	25
Intensive row cropping	None	90	35	65	3.2	160
R-R-O-M-M	None	85	30	64	3.4	170
Intensive row cropping	Terracing	85	30	64	3.4	170
R-R-R-O-M	Contouring	85	30	64	3.4	170
R-O-M-M-M	None	82	28	60	3.3	165
R-R-O-M	Terracing	82	28	60	3.3	165
R-O-M-M	Contouring	82	28	60	3.3	165
R-R-O-M-M	Stripcropping	82	28	60	3.3	165
R-O-M-M-M	None	78	25	58	3.1	155
R-R-O-M	Terracing	78	25	58	3.1	155
R-O-M-M	Contouring	78	25	58	3.1	155
R-R-O-M-M	Stripcropping	78	25	58	3.1	155
Long-term meadow	None				3.0	150
R-O-M-M	Terracing	75		56	3.0	150
R-O-M-M-M	Contouring	75		56	3.0	150
R-R-O-M-M-M or R-O-M-M-M	Stripcropping	75		56	3.0	150
Long-term meadow	None				2.9	145
R-O-M-M	Terracing	72		54	2.9	145
R-O-M-M-M	Contouring	72		54	2.9	145
R-O-M-M or R-R-O-M-M-M	Stripcropping	72		54	2.9	145

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
LaE2	Ladoga silt loam, 14 to 18 percent slopes, moderately eroded	IVe-1	Sheet erosion.
LbB	Ladoga silt loam, benches, 2 to 5 percent slopes	IIe-1	Sheet erosion.
LdD3	Ladoga soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; low fertility; poor tilth.
LdE3	Ladoga soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; low fertility; poor tilth.
Le	Lawler loam	I-1	Slight wetness.
Lh	Lawson silt loam	I-2	Slight wetness; occasional flooding.
LnD2	Lindley loam, 9 to 14 percent slopes, moderately eroded	IVe-3	Sheet erosion; low inherent fertility.
LnE2	Lindley loam, 14 to 18 percent slopes, moderately eroded	VIe-3	Sheet erosion; low inherent fertility.
LnF	Lindley loam, 18 to 25 percent slopes	VIIe-1	Sheet and gully erosion; low inherent fertility.
LnF2	Lindley loam, 18 to 25 percent slopes, moderately eroded	VIIe-1	Sheet and gully erosion; low inherent fertility.
LnG	Lindley loam, 25 to 40 percent slopes	VIIe-3	Sheet and gully erosion; low inherent fertility.
LsD3	Lindley soils, 9 to 14 percent slopes, severely eroded	VIe-3	Sheet erosion; low inherent fertility; poor tilth.
LsE3	Lindley soils, 14 to 18 percent slopes, severely eroded	VIIe-1	Sheet erosion; low inherent fertility; poor tilth.
LsF3	Lindley soils, 18 to 25 percent slopes, severely eroded	VIIe-1	Sheet and gully erosion; low inherent fertility; poor tilth.
Ma	Mahaska silty clay loam	I-1	Slight wetness.
Mu	Muscatine silty clay loam	I-1	Slight wetness.
Nc	Nevin silty clay loam	I-1	Slight wetness.
Nd	Nodaway silt loam	I-2	Slight wetness; moderate flood hazard.
Nh	Nodaway silt loam, channeled	Vw-1	Frequent flooding; old channels and bayous; ponding.
Ns	Nodaway silt loam, silty clay loam substratum	IIw-2	Wetness; moderate flooding.
Nx	Nodaway-Ely complex	IIw-1	Wetness; local flooding; gullies.
OcB	Otley silty clay loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
OcC	Otley silty clay loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.
OcC2	Otley silty clay loam, 5 to 9 percent slopes, moderately eroded.	IIIe-1	Sheet erosion.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
Long-term meadow	None				2.5	125
Long-term meadow	Contouring				2.5	125
R–O–M–M–M	Stripcropping	62		47	2.5	125
R–R–O–M–M	None	85	30	64	3.4	170
Intensive row cropping	Terracing	85	30	64	3.4	170
R–R–R–O–M	Contouring	85	30	64	3.4	170
Long-term meadow	None				2.8	140
Long-term meadow	Contouring				2.8	140
R–O–M–M–M	Terracing	70		52	2.8	140
R–O–M–M–M	Stripcropping	70		52	2.8	140
Permanent pasture [4]	(5)				2.0	100
Intensive row cropping	None	85	32	64	3.4	170
Intensive row cropping	None	95	35	72	3.5	175
Long-term meadow	None				2.2	110
Long-term meadow	Contouring				2.2	110
R–O–M–M–M	Stripcropping	55		40	2.2	110
Permanent pasture [4]	(5)				1.8	90
Permanent pasture [4]	(5)				1.5	75
Permanent pasture [4]	(5)				1.0	50
Permanent pasture [4]	(5)				.5	25
Permanent pasture [4]	(5)				1.8	90
Permanent pasture [4]	(5)				1.4	70
Permanent pasture [4]	(5)				.8	40
Intensive row cropping	None	105	40	75	4.0	200
Intensive row cropping	None	108	40	78	4.0	200
Intensive row cropping	None	98	35	72	3.8	190
Intensive row cropping	None	90	30	70	3.6	180
Permanent pasture [4]	(5)				[7] 2.0	[7] 100
Intensive row cropping	None	[7] 88	[7] 30	[7] 66	[7] 3.5	[7] 175
Intensive row cropping	None	[7] 90	[7] 30	[7] 67	[7] 3.6	[7] 180
R–R–O–M–M	None	95	35	72	3.8	190
Intensive row cropping	Terracing	95	35	72	3.8	190
R–R–R–O–M	Contouring	95	35	72	3.8	190
R–O–M–M–M	None	90	30	67	3.6	180
R–R–O–M	Terracing	90	30	67	3.6	180
R–R–O–M–M–M	Contouring	90	30	67	3.6	180
R–O–M–M–M	None	88	28	65	3.5	175
R–R–O–M	Terracing	88	28	65	3.5	175
R–R–O–M–M–M	Contouring	88	28	65	3.5	175

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TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
OcD2	Otley silty clay loam, 9 to 14 percent slopes, moderately eroded.	IIIe-3	Sheet erosion.
OcD3	Otley silty clay loam, 9 to 14 percent slopes, severely eroded.	IVe-4	Sheet erosion; poor tilth.
OcE2	Otley silty clay loam, 14 to 18 percent slopes, moderately eroded.	IVe-1	Sheet erosion.
OtB	Otley silty clay loam, benches, 2 to 5 percent slopes	IIe-1	Sheet erosion.
ShC	Shelby loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.
ShC2	Shelby loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.
ShD2	Shelby loam, 9 to 14 percent slopes, moderately eroded	IIIe-3	Sheet erosion.
ShE2	Shelby loam, 14 to 18 percent slopes, moderately eroded	IVe-1	Sheet erosion.
ShF2	Shelby loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet and gully erosion.
SoD3	Shelby soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; low fertility; poor tilth.
SoE3	Shelby soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; low fertility; poor tilth.
Sp	Sperry silt loam	IIIw-2	Severe wetness; ponding.
Sr	Stronghurst silt loam	IIw-4	Slight wetness; fertility maintenance.
St	Stronghurst silt loam, benches	IIw-4	Slight wetness; fertility maintenance.
Ta	Taintor silty clay loam	IIw-3	Moderate wetness.
TcB	Tama silty clay loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
TcC	Tama silty clay loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.
TcC2	Tama silty clay loam, 5 to 9 percent slopes, moderately eroded.	IIIe-1	Sheet erosion.
TcD2	Tama silty clay loam, 9 to 14 percent slopes, moderately eroded.	IIIe-3	Sheet erosion.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
Long-term meadow	None				3. 2	160
R-O-M-M	Terracing	80		60	3. 2	160
R-O-M-M-M	Contouring	80		60	3. 2	160
R-R-O-M-M-M or R-O-M-M	Stripcropping	80		60	3. 2	160
Long-term meadow	None				3. 0	150
R-O-M-M	Terracing	72		55	3. 0	150
R-O-M-M-M	Contouring	72		55	3. 0	150
R-O-M-M	Stripcropping	72		55	3. 0	150
Long-term meadow	None				2. 8	140
Long-term meadow	Contouring				2. 8	140
R-O-M-M-M	Stripcropping	70		52	2. 8	140
R-R-O-M-M	None	95	35	72	3. 8	190
Intensive row cropping	Terracing	95	35	72	3. 8	190
R-R-R-O-M	Contouring	95	35	72	3. 8	190
R-O-M-M	None	75	25	55	3. 0	150
R-R-O-M	Terracing	75	25	55	3. 0	150
R-R-O-M-M-M	Contouring	75	25	55	3. 0	150
R-O-M-M	None	70	23	50	2. 8	140
R-R-O-M	Terracing	70	23	50	2. 8	140
R-R-O-M-M-M	Contouring	70	23	50	2. 8	140
Long-term meadow	None				2. 6	130
R-O-M-M	Terracing	65		48	2. 6	130
R-O-M-M-M	Contouring	65		48	2. 6	130
R-O-M-M	Stripcropping	65		48	2. 6	130
Long-term meadow	([5])				2. 2	110
Permanent pasture [4]	([5])				1. 4	70
Long-term meadow	None				2. 3	115
Long-term meadow	Contouring				2. 3	115
R-O-M-M-M	Stripcropping	58		43	2. 3	115
Permanent pasture [4]	([5])				1. 8	90
Intensive row cropping	None	[7] 70	[7] 25	45	2. 5	125
R-R-R-O-M	None	85	30	65	3. 4	170
R-R-R-O-M	None	85	30	65	3. 4	170
Intensive row cropping	None	95	40	70	3. 8	190
R-R-O-M	None	100	38	75	4. 0	200
Intensive row cropping	Terracing	100	38	75	4. 0	200
R-R-R-O-M	Contouring	100	38	75	4. 0	200
R-O-M-M	None	95	35	72	3. 8	190
R-R-R-Ox	Terracing	95	35	72	3. 8	190
R-R-O-M-M	Contouring	95	35	72	3. 8	190
R-O-M-M	None	92	32	70	3. 6	180
R-R-R-Ox	Terracing	92	32	70	3. 6	180
R-R-O-M-M	Contouring	92	32	70	3. 6	180
Long-term meadow	None				3. 4	170
R-R-O-M-M	Terracing	85		65	3. 4	170
R-O-M-M	Contouring	85		65	3. 4	170
R-R-O-M-M or R-R-O-M-M-M	Stripcropping	85		65	3. 4	170

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
TcD3	Tama silty clay loam, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; low fertility; poor tilth.
TcE2	Tama silty clay loam, 14 to 18 percent slopes, moderately eroded.	IVe-1	Sheet erosion.
ThA	Tama silty clay loam, benches, 0 to 2 percent slopes	I-1	Fertility maintenance.
ThB	Tama silty clay loam, benches, 2 to 5 percent slopes	IIe-1	Sheet erosion.
TmB	Tell silt loam, 2 to 5 percent slopes	IIs-1	Sheet erosion; moderate droughtiness.
TmC	Tell silt loam, 5 to 9 percent slopes	IIIs-2	Sheet erosion; moderate droughtiness.
TmC2	Tell silt loam, 5 to 9 percent slopes, moderately eroded	IIIs-2	Sheet erosion; moderate droughtiness.
TmD2	Tell silt loam, 9 to 14 percent slopes, moderately eroded	IVe-5	Sheet erosion; moderate droughtiness.
Ud	Udolpho loam	I-1	Slight wetness; fertility maintenance.
Wa	Wabash silty clay	IIIw-1	Severe wetness; tile drainage not practical; some flooding.
Wb	Walford silt loam, benches	IIIw-2	Severe wetness; ponding water.
WkA	Watkins silt loam, 0 to 2 percent slopes	I-1	Fertility maintenance.
WkB	Watkins silt loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
WmB	Waubeek silt loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
WmC2	Waubeek silt loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.
WnA	Waukegan loam, 0 to 2 percent slopes	I-1	Slight droughtiness.
WnB	Waukegan loam, 2 to 5 percent slopes	IIe-1	Sheet erosion; droughtiness.
WnC	Waukegan loam, 5 to 9 percent slopes	IIIs-2	Droughtiness; sheet erosion.
WsB	Waukegan silt loam, 2 to 5 percent slopes	IIs-1	Sheet erosion; slight droughtiness.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
Long-term meadow	None				3. 1	155
R–R–O–M–M	Terracing	78		60	3. 1	155
R–O–M–M–M	Contouring	78		60	3. 1	155
R–R–O–M–M–M or R–O–M–M	Stripcropping	78		60	3. 1	155
Long-term meadow	None				2. 9	145
Long-term meadow	Contouring				2. 9	145
R–O–M–M	Stripcropping	72		55	2. 9	145
Intensive row cropping	None	105	40	78	4. 0	200
R–R–O–M	None	100	38	75	4. 0	200
Intensive row cropping	Terracing	100	38	75	4. 0	200
R–R–R–O–M	Contouring	100	38	75	4. 0	200
R–R–O–M–M–M	None	70	22	52	2. 8	140
R–R–R–O–M or R–R–R–Ox	Terracing	70	22	52	2. 8	140
R–R–O–M	Contouring	70	22	52	2. 8	140
R–O–M–M–M–M	None	65	20	48	2. 6	130
R–R–O–M–M	Terracing	65	20	48	2. 6	130
R–O–M–M	Contouring	65	20	48	2. 6	130
R–O–M–M–M–M	None	60	18	45	2. 4	120
R–R–O–M–M	Terracing	60	18	45	2. 4	120
R–O–M–M	Contouring	60	18	45	2. 4	120
Long-term meadow	None				2. 2	110
Long-term meadow	Contouring				2. 2	110
R–O–M–M	Terracing	52		40	2. 2	110
R–O–M–M–M or R–O–M–M	Stripcropping	52		40	2. 2	110
Intensive row cropping	None	80	30	65	3. 5	175
Intensive row cropping	None	55	25	40	2. 0	100
Intensive row cropping	None	70	28	52	2. 8	140
Intensive row cropping	None	98	35	72	3. 8	190
R–R–O–M	None	90	30	67	3. 6	180
Intensive row cropping	Terracing	90	30	67	3. 6	180
R–R–R–O–M	Contouring	90	30	67	3. 6	180
R–R–O–M–M	None	90	35	67	3. 6	180
Intensive row cropping	Terracing	90	35	67	3. 6	180
R–R–R–O–M	Contouring	90	35	67	3. 6	180
R–O–M–M–M	None	80	30	60	3. 2	160
R–R–O–M	Terracing	80	30	60	3. 2	160
R–R–O–M–M–M	Contouring	80	30	60	3. 2	160
Intensive row cropping	None	90	32	67	3. 6	180
R–R–O–M	None	85	30	64	3. 4	170
Intensive row cropping	Terracing	85	30	64	3. 4	170
R–R–R–O–M	Contouring	85	30	64	3. 4	170
R–O–M–M	None	70	25	52	2. 8	140
R–R–R–O–M	Terracing	70	25	52	2. 8	140
R–R–O–M–M	Contouring	70	25	52	2. 8	140
R–R–O–M	None	80	25	60	3. 2	160
Intensive row cropping	Terracing	80	25	60	3. 2	160
R–R–R–O–M	Contouring	80	25	60	3. 2	160

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
WsC	Waukegan silt loam, 5 to 9 percent slopes	IIIs-2	Sheet erosion; moderate droughtiness.
WtA	Wiota silt loam, 0 to 2 percent slopes	I-1	Fertility maintenance.
WtB	Wiota silt loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
Zk	Zook silty clay loam	IIw-2	Severe wetness; some flooding; slow drainage.
Zo	Zook silt loam, overwash	IIw-2	Severe wetness; some flooding; slow drainage.

[1] Number of days during a growing season that 1 acre will provide grazing for an animal unit (1 cow, horse, or steer; 5 hogs; or 7 sheep) without injury to the pasture.
[2] Continuous grass-legume meadow for 4 years or more.
[3] R=1 year of row crops; O=1 year of oats (or other small grain); M=1 year of meadow; Ox=oats followed by a green-manure catch crop.

Management of Woodland[1]

Approximately 8 percent of Iowa County is wooded. Wooded tracts occur on some farms, and large privately owned tracts are in the Amana Colonies. Most wooded areas are producing far below their capabilities. Heavy cutting in the past has resulted in understocked stands of mature trees. In addition, fires have seriously damaged large trees, interfered with natural reseeding, and destroyed the leaf litter that protected the soils from erosion. The grazing of woodlands by livestock has also caused the loss of valuable timber.

Woodlands were valued highly by the early settlers for building material and fuel. Consequently, the most desirable and best formed trees commonly were harvested. This practice resulted in a gradual decrease of the more desirable types of trees and a decline in the economic value of the woodlands of the county. Some wooded soils, notably the Lindley, Chelsea, Fayette, Clinton, and Keswick, were cleared for farming. Much of this acreage is now severely eroded and needs to be replanted to suitable trees if longtime profitable use is to be made of this land.

Native woodlands that are still in existence can be kept relatively productive of timber crops by good management practices. Such practices include protection from livestock and fire, group selective cutting, and improved cutting practices. The objective of woodland management is to attain sustained production by cutting only the amount of wood that the stand is producing in yearly growth. This cutting can be done each year or periodically every 5 or 10 years.

Conifer plantations of high quality have been established in some areas by the Amana Society, and growth on some sites has been outstanding. A notable example is the plantation on Hagener sand near South Amana. This plantation was established on a sandy ridge that was not suitable for cultivated crops. Measurements made by the U.S. Forest Service Central States Experiment Station show that the annual growth of this stand averaged more than 650 board feet per acre for the first 50 years. During the last 11 years of growth, where the stand had been thinned to 200 trees per acre, it produced 10,000 board feet per acre. Where the stand had not been thinned, it produced 7,000 board feet per acre in the same time. The height of the trees ranges from 63 to 75 feet, and the average diameter is almost 11 inches. The site index is over 70 for white pine.

Factors affecting woodland management

Soils differ in their capabilities for woodland, but the factors that influence such use are somewhat different from those that limit use of the soils for more intensively managed crops. This soil survey can help the owner of wooded tracts to determine where he can get the best returns for his investment in woodland management. Little management other than that needed to protect watersheds is justified on poor sites.

Some factors important in woodland management are discussed in the following paragraphs.

Moisture.—Of first importance among the factors that influence tree growth is the ability of the soil to supply moisture. The available moisture capacity of any soil depends largely on its slope, effective depth, texture, permeability, and internal drainage. Position on the slope and direction of exposure also affect the supply of moisture.

Slope.—Woodland management becomes more difficult as the slope increases because runoff increases, the rate of

[1] By SYLVAN T. RUNKEL, woodland specialist, and JOHN W. BEDISH, soil conservationist, Soil Conservation Service.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
R-O-M-M	None	73	23	52	2. 8	140
R-R-R-O-M	Terracing	73	23	52	2. 8	140
R-R-O-M-M	Contouring	73	23	52	2. 8	140
R-R-O-M-M	Stripcropping	73	23	52	2. 8	140
Intensive row cropping	None	105	40	75	4. 0	200
R-R-O-M	None	95	35	72	3. 8	190
Intensive row cropping	Terracing	95	35	72	3. 8	190
R-R-R-O-M	Contouring	95	35	72	3. 8	190
Intensive row cropping	None	[7] 70	[7] 30	[7] 50	[7] 2. 5	[7] 125
Intensive row cropping	None	[7] 75	32	50	2. 5	125

[4] Also suitable for wildlife.
[5] Not suitable for cultivated crops.
[6] Corn or soybeans for 4 years or more.
[7] Variable because of flooding or lack of drainage.

infiltration decreases, and the erosion hazard becomes greater.

Aspect, or direction of exposure.—Forest studies show a definite relationship between the exposure of a site and the rate of tree growth (*27*).[2] Although all of the factors involved in exposure are not fully understood, some that play an important role are (1) differences in the rate of evaporation as influenced by the prevailing wind, (2) length of time the snow cover remains on the ground, (3) amount of freezing and thawing, and (4) differences in soil temperature.

Fairly level soils and slopes that face southeast, east, northeast, north, and northwest are relatively cool and are more desirable for growing trees than hot sites. Less desirable sites are the narrow ridgetops, the upper part of slopes, and slopes of more than 14 percent that face south, southwest, and west. These less desirable sites are subject to excessive heating and to drying from south or west winds.

Erosion.—Severe erosion causes loss of the surface soil and thus reduces the total thickness of the soil, particularly the part where moisture is stored. In addition, it commonly exposes the heavier, less porous subsoil and thereby contributes to increased runoff and a lower rate of water intake. A severely eroded soil is less desirable for both natural reseeding and tree growth than an uneroded soil of the same series and same slope. Because native hardwood stands are the result of longtime buildup, eroded sites will not support hardwoods. However, these sites generally can be used for pine.

Soil reaction and soil fertility.—These factors have some influence on the adaptation and growth of different species of trees. For example, walnut and locust trees grow best on neutral or slightly calcareous soils. Pine needs a slightly acid soil. Most species of pine, especially the native species, are poorly suited to soils that are high in lime. On the other hand, hardwoods commonly grow well on those soils. Eastern redcedar is also tolerant of lime.

Hardwoods should not be planted on eroded or depleted soils and generally are poorly suited to old formerly cultivated soils, whereas pine grows fairly well on these poorer sites.

[2] Italic numbers in parentheses refer to Literature Citations, page 161.

Forest types

Iowa County lies within the central hardwood forest region. Thus, hardwoods are dominant in native woodlands.

Oak-hickory type.—This type of woodland occurs mainly where the soils are thick, the supply of moisture is average, and slopes are gently rolling to steep. The stands consist mainly of oak and hickory but also include some elm, basswood, hackberry, green ash, and cherry.

Planted evergreen type.—Pine plantations have been established since the county was first settled. Some plantings are in sandy areas. Others are used for windbreaks around farm buildings. The principal conifers in these plantings are eastern white pine, red pine, Austrian pine, Douglas-fir, Scotch pine, and Norway spruce.

Soft maple-elm-cottonwood type.—This type of forest occurs on bottom lands, especially on Alluvial land and on the Nodaway and Amana soils. On second bottoms, generally above the flood plain, are found red elm, American elm, willow, cottonwood, soft maple, swamp white oak, bur oak, shellbark hickory, green ash, and some black walnut. The principal wooded soils on second bottoms are the Bertrand, Jackson, Koszta, and Watkins.

Suitability of trees for various uses

Trees suitable for planting as windbreaks around farmsteads or as protection from drifting snow are eastern white pine, eastern redcedar, Scotch pine, red pine, and Norway spruce. To make the windbreak more effective, one or two rows of honeysuckle or other such plant can be grown around the outside of the windbreak.

Trees suitable for planting in, across, or around crop fields to help control wind erosion are hybrid poplars (cottonwood), eastern redcedar, eastern white pine, Scotch pine, and red pine. In places trees are planted across the field in single rows and in patterns to protect the entire field. Single rows, spaced 20 to 40 rods apart, will protect most soils from wind erosion and are especially effective on sandy soils.

Woodland suitability groups

Management of woodland can be planned more effectively if soils are grouped according to those characteristics that affect the growth of trees and the management of the stands. For this reason, the soils of Iowa County have been placed in nine woodland suitability groups. Each group consists of soils that have about the same suitability for wood crops, require about the same management, and have about the same potential productivity.

In each group, trees most suitable for forest, windbreaks, or Christmas trees are listed. Also listed are the trees and shrubs most suitable for wildlife cover. These include some species that provide food as well as cover.

In table 3, the site index and the annual production of hardwoods are given for the woodland suitability groups in this county. The site index is the height, in feet, of the dominant trees in the stand at age 50 years (*17*).

TABLE 3.—*Soil ratings for tree planting and woodland production*

Soil series and mapping symbol	Aspect	Woodland suitability group	Site index for upland oaks	Hardwood production in board feet per acre per year [1]
Adair:				
AaC2, AaD2, AcD2, AdD3, AeD3	All aspects	7	(2)	(3)
AaE2, AcE2, AdE3, AeE3, AeF3	North and east slopes	7	(2)	(3)
AaE2, AcE2, AdE3, AeE3, AeF3	South and west slopes	8	(2)	(3)
Alluvial land:				
Al	All aspects	3 or 6	60 [4]	[5 6] 200–700
Amana:				
Am	All aspects	6	61 (59–65)	210
Amana-Lawson-Nodaway complex:				
An	All aspects	6	60 [4]	200
Atterberry:				
As, At	All aspects	4	55 [4]	150
Bassett:				
BaC2, BaD2, BeD3	All aspects	4	50 (48–56)	125
BaE2, BaF2, BeE3	North and east slopes	4	50 (48–56)	125
BaE2, BaF2, BeE3	South and west slopes	5	50 (48–56)	125
Bertrand:				
BrA, BrB, BrC2	All aspects	4	65 [4]	220
Bremer:				
Bs, Bt	All aspects	7	(2)	(3)
Chariton:				
Ca	All aspects	7	(2)	(3)
Chelsea:				
CeB, CeD	All aspects	1	56 (47–63)	160
CeG	North and east slopes	1	56 (47–63)	160
CeG	South and west slopes	2	56 (47–63)	160
Chelsea-Fayette-Lamont complex:				
CfC, CfD, CfD2	All aspects	1	65 [4]	220
CfE, CfE2, CfG	North and east slopes	1	65 [4]	220
CfE, CfE2, CfG	South and west slopes	2	65 [4]	220
Clinton:				
ClB, ClC, ClC2, ClD, ClD2 CnD3	All aspects	4	81	300
ClE2, ClF2, CnE3	North and east slopes	4	81	300
ClE2, ClF2, CnE3	South and west slopes	5	81	300

See footnotes at end of table.

TABLE 3.—*Soil ratings for tree planting and woodland production*—Continued

Soil series and mapping symbol	Aspect	Woodland suitability group	Site index for upland oaks	Hardwood production in board feet per acre per year [1]
Colo:				
Co, Cs	All aspects	9	(2)	(3)
Colo-Ely complex:				
Ct	All aspects	9	(2)	(3)
Coppock:				
Cu	All aspects	7	(2)	(3)
Dickinson:				
DcA, DcB, DcC	All aspects	1	(2)	(3)
Dinsdale:				
DdB, DdC	All aspects	4	(2)	(3)
Downs:				
DoB, DoC, DoC2, DoD2, DpB, DsD3	All aspects	4	52	135
DoE2, DsE3	North and east slopes	4	52	135
DoE2, DsE3	South and west slopes	5	52	135
Ely:				
EsB	All aspects	4	(2)	(3)
Fayette:				
FaB, FaC, FaC2, FaD, FaD2, FbB, FsD3	All aspects	4	68 (54–74)	250
FaE, FaE2, FaF, FaF2, FaG, FsE3, FsF3	North and east slopes	4	68 (54–74)	250
FaE, FaE2, FaF, FaF2, FaG, FsE3, FsF3	South and west slopes	5	68 (54–74)	250
Gara:				
GaC2, GaD2, GrD3	All aspects	4	57	160
GaE2, GaF2, GrE3, GrF3	North and east slopes	4	57	160
GaE2, GaF2, GrE3, GrF3	South and west slopes	5	57	160
Givin:				
Gs	All aspects	4	70 [4]	260
Gullied land:				
Gu	North and east slopes	4	50 [4]	125
Gu	South and west slopes	5	50 [4]	125
Hagener:				
HaA, HaB, HaC, HaD	All aspects	1	(2)	(3)
HaE	North and east slopes	1	(2)	(3)
HaE	South and west slopes	2	(2)	(3)
Hagener-Tama complex:				
HgB, HgC, HgC2, HgD2	All aspects	1	(2)	(3)
HgE2	North and east slopes	1	(2)	(3)
HgE2	South and west slopes	2	(2)	(3)
Hopper:				
HoD2	All aspects [7]	4	45 [4]	80
HoE2, HoE3, HoF2	North and east slopes [7]	4	45 [4]	80
HoE2, HoE3, HoF2	South and west slopes [7]	5	45 [4]	80
Jackson:				
Ja	All aspects	4	60 [4]	190
Judson:				
JuB	All aspects	4	(2)	(3)
Kenyon:				
KnB, KnC, KnC2, KnD2	All aspects	4	(2)	(3)
Keomah:				
Ko	All aspects	4	57 [4]	160

See footnotes at end of table.

TABLE 3.—*Soil ratings for tree planting and woodland production*—Continued

Soil series and mapping symbol	Aspect	Woodland suitability group	Site index for upland oaks	Hardwood production in board feet per acre per year [1]
Keswick:				
KsD2, KwD3	All aspects	7	55 [4]	150
KsE2, KsF2, KwE3, KwF3	North and east slopes	7	55 [4]	150
KsE2, KsF2, KwE3, KwF3	South and west slopes	8	55 [4]	150
Koszta:				
Kz	All aspects	4	(2)	(3)
Ladoga:				
LaB, LaC, LaC2, LaD, LaD2, LdD3, LbB	All aspects	4	64	210
LaE2, LdE3	North and east slopes	4	64	210
LaE2, LdE3	South and west slopes	5	64	210
Lawler:				
Le	All aspects	4	(2)	(3)
Lawson:				
Lh	All aspects	4	(2)	(3)
Lindley:				
LnD2	All aspects	4	55 [4]	150
LnE2, LnF, LnF2, LnG, LsD3, LsE3, LsF3	North and east slopes	4	55 [4]	150
LnE2, LnF, LnF2, LnG, LsD3, LsE3, LsF3	South and west slopes	5	55 [4]	150
Mahaska:				
Ma	All aspects	4	(2)	(3)
Muscatine:				
Mu	All aspects	4	(2)	(3)
Nevin:				
Nc	All aspects	4	(2)	(3)
Nodaway:				
Nd, Nh, Ns	All aspects	6	58 (51–64)	180
Nodaway-Ely complex:				
Nx	All aspects	6	(2)	(3)
Otley:				
OtB, OcB, OcC, OcC2, OcD2, OcD3	All aspects	4	(2)	(3)
OcE2	North and east slopes	4	(2)	(3)
OcE2	South and west slopes	5	(2)	(3)
Shelby:				
ShC, ShC2, ShD2, SoD3	All aspects	4	(2)	(3)
ShE2, ShF2, SoE3	North and east slopes	4	(2)	(3)
ShE2, ShF2, SoE3	South and west slopes	5	(2)	(3)
Sperry:				
Sp	All aspects	7	(2)	(3)
Stronghurst:				
Sr, St	All aspects	4	70 [4]	265
Taintor:				
Ta	All aspects	1	(2)	(3)
Tama:				
TcB, TcC, TcC2, TcD2, TcD3, ThA, ThB	All aspects	4	(2)	(3)
TcE2	North and east slopes	4	(2)	(3)
TcE2	South and west slopes	5	(2)	(3)
Tell:				
TmB, TmC, TmC2, TmD2	All aspects	4	50 [4]	125

See footnotes at end of table.

TABLE 3.—*Soil ratings for tree planting and woodland production*—Continued

Soil series and mapping symbol	Aspect	Woodland suitability group	Site index for upland oaks	Hardwood production in board feet per acre per year [1]
Udolpho:				
Ud	All aspects	4	(2)	(3)
Wabash:				
Wa	All aspects	9	(2)	(3)
Walford:				
Wb	All aspects	7	50 [4]	125
Watkins:				
WkA, WkB	All aspects	4	51 [4]	130
Waubeek:				
WmB, WmC2	All aspects	4	51 [4]	130
Waukegan:				
WnA, WnB, WnC, WsB, WsC	All aspects	4	(2)	(3)
Wiota:				
WtA, WtB	All aspects	4	(2)	(3)
Zook:				
Zk, Zo	All aspects	9	(2)	(3)

[1] Figure is for fully stocked, even-aged stands under high-level management (*17*).
[2] No site index because these are mainly prairie-derived soils on which native woodland does not commonly occur.
[3] Mainly prairie-derived soils on which native hardwoods generally do not occur.
[4] Site index value estimated.
[5] Variable on bottom lands. Maximum production from cottonwood; lowest from elm, ash, and soft maple.
[6] Higher production is for species for which no site index has been measured.
[7] High content of lime at depth of about 20 inches restricts growth of coniferous trees.

WOODLAND SUITABILITY GROUP 1

The soils in this group generally are droughty because they are steep, rapidly permeable, or shallow. They vary widely in slope. The soils that have a slope range of 0 to 14 percent have all exposures. Those that slope more than 14 percent have northern and eastern exposures.

The trees suitable for planting are—

Eastern redcedar.	Eastern white pine.
Scotch pine.	European larch.
Jack pine.	Red pine.

The shrubs and trees suitable for wildlife cover are—

Honeysuckle.	Wild plum.
Eastern redcedar.	Aromatic sumac.
Russian-olive.	

WOODLAND SUITABILITY GROUP 2

The soils in this group are similar to the soils described in group 1, except that they have a slope range of 14 percent or more and have southern or western exposures. Growing conditions for the most plants are more difficult in this group than in group 1 because climatic extremes are greater.

The trees suitable for planting are—

Eastern redcedar.	Jack pine.
Scotch pine.	Red pine.

The shrubs and trees suitable for wildlife cover are—

Russian-olive.	Eastern redcedar.
Honeysuckle.	

WOODLAND SUITABILITY GROUP 3

This group consists of soils that are similar to those of group 1, except that they are subject to repeated overflow.

The trees suitable for planting are—

Cottonwood.	Soft maple.

The shrubs and trees suitable for wildlife cover are—

Russian-olive.	Eastern redcedar.

WOODLAND SUITABILITY GROUP 4

This group consists of deep, moderately permeable soils in coves, on second bottoms, and on level to sloping uplands. The soils that have a slope range of 0 to 14 percent generally have all exposures. Those that slope more than

14 percent commonly have northern and eastern exposures. The soils of this group generally are considered good agricultural soils and are also favorable for wood crops.

The trees suitable for planting are—

Eastern white pine.	Black walnut.
Scotch pine.	Cottonwood.
Red pine.	Green ash.
Norway spruce.	White ash.
European larch.	Basswood.
Black cherry (without spiral grain).	Red oak.[3]
	White oak.[3]

The shrubs and trees suitable for wildlife cover are—

Nannyberry.	Asiatic trailing raspberry.
Blackhaw.	Ninebark.
Eastern redcedar.	Highbush cranberry.
Multiflora rose.	Lilac.
Wild plum.	Hazelnut.
Dogwood (native).	Aromatic sumac.

WOODLAND SUITABILITY GROUP 5

The soils in this group are similar to the soils in group 4, except that they occur only on south-facing or west-facing slopes of 14 percent or more. Thus, growing conditions for plants are less favorable in this group than in group 4.

The trees suitable for planting are—

Eastern white pine.	Black cherry.
Scotch pine.	Green ash.
Jack pine.	White ash.
Red pine.	Cottonwood.
Norway spruce.	Eastern redcedar.
Black walnut.	

The shrubs and trees suitable for wildlife cover are—

Ninebark.	Asiatic trailing raspberry.
Honeysuckle.	Nannyberry.
Wild plum.	Aromatic sumac.
Mulberry.	Highbush cranberry.
Chokecherry.	Multiflora rose.
Eastern redcedar.	Russian-olive.
Hazelnut.	Blackhaw.

WOODLAND SUITABILITY GROUP 6

The soils in this group are similar to the soils described in group 4, except that they are subject to repeated flooding.

The trees suitable for planting are—

Black walnut.	Cottonwood.
Green ash.	Soft maple.
Sycamore.	Hackberry.

The shrubs and trees suitable for wildlife cover are—

Redosier dogwood.	Honeysuckle.

WOODLAND SUITABILITY GROUP 7

The soils in this group are moderately permeable to very slowly permeable. Those that have a slope range of 0 to 14 percent generally have all exposures. Those that slope more than 14 percent, generally have northern or western exposures.

The trees suitable for planting are—

Cottonwood.	Eastern redcedar.
Green ash.	Eastern white pine.[4]
Hackberry.	Norway spruce.[4]
Sycamore.	

The shrubs and trees suitable for wildlife cover are—

Redosier dogwood.	Wild plum.
Eastern redcedar.	

WOODLAND SUITABILITY GROUP 8

This group consists of soils that are similar to the soils in group 7, except that they occur on south-facing or west-facing slopes of 14 percent or more. These soils normally have slowly permeable subsoil. They are exposed to drying winds during the growing season and to extremes in temperature during most seasons of the year.

The trees suitable for planting are—

Eastern redcedar.	Green ash.
Cottonwood.	Jack pine.

The shrubs and trees suitable for wildlife cover are—

Eastern redcedar.	Wild plum.

WOODLAND SUITABILITY GROUP 9

The soils of this group are similar to those in group 7, except that they are subject to flooding.

The trees suitable for planting are—

Cottonwood.	Soft maple.
Green ash.	

Honeysuckle is a suitable shrub for wildlife cover.

Engineering Applications

For a long time engineers have studied soil characteristics that affect construction and have devised systems of soil classification based on these characteristics. Most of these studies have been at the site of construction because general information about the soils of an area has not been readily available.

With the use of the soil map for identification, the interpretations reported here can be useful to the planning engineer. It should be emphasized that these interpretations may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads or where the excavations are deeper than the depth of layers here reported. Even in these situations, however, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

At many construction sites, major variations occur in a soil within the depth of proposed excavation, and several soil units can occur within short distances. By using the information in a soil survey report, the soil engineer can concentrate on the most important soil units. Then he

[3] Acorns can be used.

[4] Plant only on the moderately permeable soils.

can obtain a minimum number of soil samples for laboratory testing and can make adequate soil investigations at minimum cost.

This soil survey report contains information that can be used by engineers to—

1. Make studies of soil and land use that will aid in the selection and development of industrial, business, residential, and recreational sites.
2. Assist in planning and designing drainage and irrigation structures and in planning dams and other structures for water and soil conservation.
3. Make reconnaissance surveys of soil and ground conditions that will aid in selecting highway and airport locations and in planning more detailed soil surveys for the intended locations.
4. Locate probable sources of sand and gravel for use in structures.
5. Correlate pavement performance with types of soil, and thus develop information that will be useful in designing and maintaining pavements.
6. Determine the suitability of soils for cross-country movements of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports, and from aerial photographs, for the purpose of making maps and reports that can be readily used by engineers.

Some of the terms used by the agricultural soil scientist may be unfamiliar to the engineer and some words—for example, soil, clay, silt, and sand—have special meanings in soil science. These and other special terms used in the soil survey report are defined in the Glossary in the back of this report.

Engineering Classification Systems

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system soil materials are classified in seven principal groups. The groups range from A–1, consisting of gravelly soil of high-bearing capacity, to A–7, which is made up of clayey soils having low strength when wet.

Some engineers prefer to use the Unified soil classification system (*26*). In this system, soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic. An approximate classification can be made in the field. Estimated classification of the soils in Iowa County, under both systems, is given in table 4.

Soil Engineering Data and Interpretations

Information and interpretations of most significance to engineers are presented in tables 4, 5, and 6.

The data in table 4 are based on the test data in table 6, on information in other parts of the report, and on experience with the same kind of soil in other counties. The percentage passing sieves is the normal range of soil particles passing the respective screen sizes.

Permeability refers to the rate of movement of water through the undisturbed soil. Permeability depends largely on the soil texture and structure.

Available moisture capacity is the amount of water in a moist soil, at field capacity, that can be removed by plants. These ratings, expressed in inches of water per inch of soil depth, are of particular value to engineers engaged in irrigation.

Shrink-swell potential is a rating of the ability of soil material to change volume when subjected to changes in moisture. Those soil materials rated high are normally undesirable from the engineering standpoint, since the increase in volume when the dry soil is wetted is usually accompanied by a loss in bearing capacity. In general, soils classed as CH and A–7 have a high shrink-swell potential. Clean sands and gravels (single-grain structure) and soils having small amounts of nonplastic to slightly plastic fines have a low shrink-swell potential.

In table 5 are estimates of the suitability of the soils of the county for various engineering uses.

Table 6, page 120, presents laboratory test data for samples taken from nine soil profiles in Iowa County.

Additional information can be obtained from other parts of the report, particularly the sections "General Soil Map," "Descriptions of the Soils," and "Genesis, Classification, and Morphology of the Soils."

Soil Features Affecting Highway Work [5]

Many of the soils in Iowa County developed in loess that overlies glacial till. The loess ranges from as much as 15 feet in thickness on the nearly level uplands and tops of ridges to a thin layer in the more sloping, dissected areas.

Soils that developed in glacial till are in the more sloping dissected areas, where the glacial till crops out. The till is of Kansan age, except in a small area in the northeastern part of the county where the till is Iowan drift (*8*).

The glacial till in Iowa County has a relatively high in-place density. It is relatively stable at any moisture content and can be compacted readily to high density. The textural composition varies, but when the material is dry there are enough fines and enough coarse material to provide a firm riding surface, with little rebound after loading. The glacial till has good bearing capacity when compacted to maximum practical density but loses this bearing capacity when moisture is absorbed.

The Mahaska, Muscatine, and other soils derived from loess in nearly level areas are fine textured and are classified A–7 (CL–OL). These soils have high group index numbers. Their surface layer is highly organic and is difficult to compact to good density. Their subsoil is a plastic silty clay loam that expands readily and does not make a desirable upper subgrade. Such soils as the Otley, Ladoga, and Clinton formed in loess in more sloping areas. These soils have a less well developed surface layer than the more nearly level soils and a less plastic subsoil. Their subsoil is classified A–7 (CL–CH) and has rather high group index numbers. Loessal soils erode readily if runoff is concentrated. Sodding, paving, or check dams may be needed in gutters and ditches to prevent excessive erosion.

[5] This subsection was prepared by ROBERT E. BLATTERT, soils geologist, Iowa State Highway Commission.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Adair, thin solum (AcD2, AcE2, AeD3, AeE3, AeF3).	0 to 6	Clay loam to loam	CL	A-6(8-12)
	6 to 49	Clay loam to clay	CL or CH	A-7-6(15-20)
	49 to 65	Loam to clay loam	CL	A-6(8-12)
Adair (AaC2, AaD2, AaE2, AdD3, AdE3).	0 to 8	Clay loam to loam	CL or CH	A-7-6(11-15)
	8 to 54	Clay to clay loam	CH	A-7-6(18-20)
	54 to 65	Clay loam	CL or CH	A-7-6(12-18)
Alluvial land (Al).[1]				
Amana (Am, and part of An).	0 to 15	Silt loam	ML or CL	A-6(8) to A-7-6(12)
	15 to 48	Silty clay loam	ML or CL	A-7-6(11-15)
	48 to 62	Silt loam	ML or CL	A-7-6(9-12)
Atterberry (As).	0 to 13	Silt loam	ML or CL	A-6(9-12)
	13 to 50	Silty clay loam	CL	A-7-6(12-16)
	50 to 60	Silt loam	ML or CL	A-6(10) to A-7-6(13)
Atterberry, benches (At).	0 to 10	Silt loam	ML or CL	A-6(9-12)
	10 to 40	Silty clay loam	CL	A-7-6(12-16)
	40 to 50	Silt loam	ML or CL	A-6(10) to A-7-6(13)
Bassett (BaC2, BaD2, BaE2, BaF2, BeD3, BeE3).	0 to 6	Loam or silt loam	ML or CL	A-4(8) to A-6(12)
	6 to 47	Clay loam	CL	A-4(4) to A-6(8)
	47 to 60	Loam	CL	A-4(4) to A-6(10)
Bertrand (BrA, BrB, BrC2).	0 to 10	Silt loam	ML or CL	A-4(7) to A-6(10)
	10 to 42	Silt loam to silty clay loam.	CL	A-6(8-12)
	42 to 55	Silt loam	ML or CL	A-4(6) to A-6(9)
Bremer (Bs).	0 to 21	Silty clay loam	MH or CH	A-7-6(12-16)
	21 to 35	Silty clay loam to silty clay.	CH or CL	A-7-6(16-18)
	35 to 45	Silty clay loam	CH or CL	A-7-6(13-17)
Bremer, overwash (Bt).	0 to 18	Silt loam	ML or CL	A-6(10) to A-7-6(14)
	18 to 36	Silty clay loam	MH or CH	A-7-6(12-16)
	36 to 60	Silty clay loam to silty clay.	CH or CL	A-7-6(16-18)
Chariton (Ca).	0 to 14	Silt loam	ML or CL	A-6 (10-12)
	14 to 25	Silt loam	ML or CL	A-4(8) to A-6(10)
	25 to 41	Silty clay loam to silty clay.	CH	A-7-6(18-20)
	41 to 50	Silty clay loam	CH	A-7-6(16-20)
Chelsea (CeB, CeD, CeG, and parts of CfC, CfD, CfD2, CfE, CfE2, CfG).	0 to 5	Fine sand	SM or SP	A-3
	5 to 73	Fine sand	SM or SP	A-3
Clinton (ClB, ClC, ClC2, ClD, ClD2, ClE2, ClF2, CnD3, CnE3).	0 to 10	Silt loam	ML or CL	A-6(10) to A-7-6(12)
	10 to 54	Silty clay loam	CL	A-7-6(12-15)
	54 to 66	Silt loam to silty clay loam.	CL	A-6(10) to A-7-6(13)

See footnote at end of table.

significant in engineering

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
No. 4	No. 10	No. 200					
			Inches per hour	*Inches per inch of soil*	*pH*		
95 to 100	80 to 95	60 to 80	0.2 to 0.8	0.17	6.6 to 7.3	Moderate.	Seasonally wet and seepy.
95 to 100	80 to 95	55 to 80	0.05 to 0.2	.15	5.2 to 6.0	High.	
95 to 100	80 to 95	55 to 80	0.2 to 0.8	.15	6.1 to 6.5	Moderate.	
95 to 100	80 to 95	65 to 80	0.2 to 0.8	.17	6.6 to 7.3	Moderate to high.	Seasonally wet and seepy.
95 to 100	80 to 95	65 to 80	<0.05	.16	5.2 to 5.8	High.	
95 to 100	80 to 95	55 to 80	0.05 to 0.2	.15	6.1 to 6.5	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.20	5.8 to 6.6	Moderate.	Generally flooded in spring and occasionally at other times; seasonal high water table.
----------	100	95 to 100	0.8 to 2.5	.19	5.6 to 6.0	Moderate to high.	
----------	100	90 to 100	0.8 to 2.5	.17	5.6 to 6.0	Moderate.	
----------	100	95 to 100	0.8 to 2.5	.20	6.6 to 7.3	Moderate.	Seasonal high water table at or near the surface for short periods.
----------	100	95 to 100	0.8 to 2.5	.19	5.6 to 6.0	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.17	6.1 to 6.5	Moderate.	
----------	100	95 to 100	0.8 to 2.5	.20	6.6 to 7.3	Moderate.	Seasonal high water table at or near the surface; sand strata below a depth of 4 feet in some places.
----------	100	95 to 100	0.8 to 2.5	.19	5.5 to 6.0	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.17	6.1 to 6.5	Moderate.	
95 to 100	80 to 90	55 to 65	0.8 to 2.5	.19	6.6 to 7.3	Moderate.	Water table generally below depth of 5 to 10 feet; some gravel and stones throughout; small pockets of sand and gravel in till.
90 to 95	80 to 90	50 to 60	0.2 to 0.8	.17	5.2 to 5.8	Moderate.	
95 to 100	80 to 90	50 to 60	0.8 to 2.5	.16	6.6 to 7.3	Moderate.	
----------	100	90 to 100	0.8 to 2.5	.18	6.0 to 6.6	Moderate.	Thin stratified lenses of sand and silt below depth of 3½ feet; water table normally below depth of 5 feet.
----------	100	90 to 100	0.8 to 2.5	.17	5.1 to 5.6	Moderate.	
95 to 100	90 to 100	80 to 90	0.8 to 2.5	.15	5.1 to 5.6	Moderate.	
----------	100	95 to 100	0.2 to 0.8	.21	6.6 to 7.3	Moderate to high.	Occasionally flooded; seasonal high water table at or near the surface.
----------	100	95 to 100	0.05 to 0.2	.20	6.1 to 6.5	Moderate to high.	
----------	100	95 to 100	0.2 to 0.8	.18	6.1 to 6.5	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.19	6.1 to 6.6	Moderate.	Subject to flooding by overflow from adjacent streams or by runoff from higher areas; seasonal high water table normally at or near the surface.
----------	100	95 to 100	0.2 to 0.8	.20	6.1 to 6.6	Moderate to high.	
----------	100	95 to 100	0.05 to 0.2	.17	6.1 to 6.6	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.20	6.1 to 6.6	Moderate.	Seasonal high water table at or near the surface; water occasionally stands on the surface.
----------	100	95 to 100	0.8 to 2.5	.18	5.6 to 6.0	Low to moderate.	
----------	100	95 to 100	<0.05	.18	5.6 to 6.6	High.	
----------	100	95 to 100	0.2 to 0.8	.17	6.1 to 6.6	High.	
100	95 to 100	10 to 35	5.0 to 10.0	.04	5.6 to 6.0	None.	
100	95 to 100	8 to 20	5.0 to 10.0	.02	5.1 to 5.6	None.	
----------	100	95 to 100	0.8 to 2.5	.18	6.0 to 6.8	Moderate to high.	Water table at depth of 10 feet or more.
----------	100	95 to 100	0.2 to 0.8	.17	5.4 to 5.9	Moderate to high.	
----------	100	95 to 100	0.5 to 1.5	.15	6.4 to 6.8	Moderate to high.	

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Colo (Co and part of Ct).	0 to 43	Silty clay loam	CH or OL	A-7-6(12-16)
	43 to 60	Silty clay loam	CL	A-7-6(11-15)
Colo, overwash (Cs).	0 to 18	Silt loam	CL or ML	A-6(10) to A-7-6(14)
	18 to 50	Silty clay loam	OL or CL	A-7-6(12-16)
Coppock (Cu).	0 to 9	Silt loam	ML or CL	A-6(8-12)
	9 to 24	Silt loam	ML or CL	A-6(8-10)
	24 to 49	Silty clay loam	CL or CH	A-7-6(14-17)
	49 to 62	Silty clay loam	CL	A-7-6(11-14)
Dickinson (DcA, DcB, DcC).	0 to 15	Sandy loam	SM or SC	A-2 or A-4
	15 to 30	Sandy loam	SM or SC	A-2 or A-4
	30 to 52	Loamy sand	SM	A-2-4
Dinsdale (DdB, DdC).	0 to 17	Silty clay loam	CL	A-6(9-12)
	17 to 31	Silty clay loam	CL	A-7-6(12-16)
	31 to 50	Loam	CL	A-6(6-10)
	50 to 65	Loam	CL	A-6(6-10)
Downs (DoB, DoC, DoC2, DoD2, DoE2, DsD3, DsE3).	0 to 13	Silt loam	ML or CL	A-4(6-8)
	13 to 49	Silty clay loam	CL	A-6(8) to A-7-6(12)
	49 to 60	Silt loam	ML or CL	A-6(6) to A-7-6(10)
Downs, benches (DpB).	0 to 10	Silt loam	ML or CL	A-4(6-8)
	10 to 36	Silty clay loam	CL	A-6(8) to A-7-6(12)
	36 to 50	Silt loam	ML or CL	A-7-6(10)
Ely (EsB and parts of Ct and Nx).	0 to 40	Silt loam and silty clay loam.	CL or OL	A-7-6(12-17)
	40 to 58	Silty clay loam and silt loam.	CL	A-7-6(12-17)
	58 to 65	Silt loam	CL	A-6(12) to A-7-6(14)
Fayette (FaB, FaC, FaC2, FaD, FaD2, FaE, FaE2, FaF, FaF2, FaG, FsD3, FsE3, FsF3, and parts of CfC, CfD, CfD2, CfE, CfE2, CfG).	0 to 8	Silt loam	ML or CL	A-4(8) to A-6(12)
	8 to 46	Silty clay loam	CL	A-7-6(12-15)
	46 to 58	Silt loam	CL	A-6(10) to A-7-6(13)
Fayette, benches (FbB).	0 to 8	Silt loam	ML or CL	A-4(8) to A-6(12)
	8 to 40	Silty clay loam	CL	A-7-6(12-15)
	40 to 50	Silt loam	CL	A-6(10) to A-7-6(13)
Gara (GaC2, GaD2, GaE2, GaF2, GrD3, GrE3, GrF3).	0 to 12	Loam	CL	A-4(3) to A-6(8)
	12 to 47	Clay loam	CL	A-6(9) to A-7-6(14)
	47 to 60	Loam	CL	A-6(6-10)
Givin (Gs).	0 to 12	Silt loam	ML or CL	A-6(10) to A-7-6(13)
	12 to 50	Silty clay loam	CL or CH	A-7-6(14-18)
Gullied land (Gu).[1]				
Hagener (HaA, HaB, HaC, HaD, HaE, and parts of HgB, HgC, HgC2, HgD2, HgE2).	0 to 9	Fine sand	SM or SP	A-2-4(0)
	9 to 54	Fine sand	SM or SP	A-2 or A-3
Hopper (HoD2, HoE2, HoE3, HoF2).	0 to 8	Silt loam	ML or CL	A-4(8) to A-6(11)
	8 to 23	Silt loam	ML or CL	A-4(7) to A-6(10)
	23 to 34	Silt loam	ML or CL	A-4(4-8)

See footnote at end of table.

significant in engineering—Continued

Percentage passing sieve— No. 4	No. 10	No. 200	Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
			Inches per hour	*Inches per inch of soil*	*pH*		
-----------	100	95 to 100	0. 2 to 0. 8	0. 21	6. 0 to 6. 6	Moderate to high.	Subject to flooding; seasonal high water table.
-----------	100	95 to 100	0. 2 to 0. 8	. 19	6. 0 to 6. 8	Moderate to high.	
-----------	100	95 to 100	0. 8 to 2. 5	. 19	6. 0 to 6. 8	Moderate.	Frequently flooded for short periods.
-----------	100	95 to 100	0. 2 to 0. 8	. 21	6. 0 to 6. 8	Moderate to high.	
-----------	100	95 to 100	0. 8 to 2. 5	. 20	6. 0 to 6. 8	Moderate.	Subject to flooding for short periods; seasonal high water table.
-----------	100	95 to 100	0. 8 to 2. 5	. 18	5. 4 to 5. 8	Low to moderate.	
-----------	100	95 to 100	0. 2 to 0. 8	. 19	5. 6 to 6. 0	Moderate to high.	
-----------	100	95 to 100	0. 2 to 0. 8	. 17	6. 0 to 6. 6	Moderate.	
100	80 to 90	25 to 50	2. 5 to 5. 0	. 10	6. 0 to 6. 6	Low.	Water table normally at depth of more than 10 feet.
100	80 to 90	25 to 50	2. 5 to 5. 0	. 06	5. 2 to 6. 0	Low.	
100	75 to 90	20 to 35	5. 0 to 10. 0	. 03	5. 2 to 6. 0	Very low.	
-----------	100	95 to 100	0. 8 to 2. 5	. 21	6. 0 to 6. 6	Moderate.	Sand lenses, several inches thick, common between loess and underlying glacial till; water table normally at depth of more than 5 feet.
-----------	100	95 to 100	0. 8 to 2. 5	. 19	5. 5 to 6. 0	Moderate to high.	
95 to 100	80 to 90	50 to 65	0. 8 to 2. 5	. 16	5. 5 to 6. 0	Moderate.	
95 to 100	80 to 90	50 to 65	0. 8 to 2. 5	. 15	6. 6 to 7. 4	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 19	6. 0 to 7. 0	Moderate.	Water table normally at depth of 10 feet or more.
-----------	100	95 to 100	0. 8 to 2. 5	. 18	5. 2 to 5. 8	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 16	5. 6 to 6. 0	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 19	6. 0 to 7. 0	Moderate.	Sand strata at depth of 4 feet in some places.
-----------	100	95 to 100	0. 5 to 1. 5	. 18	5. 8 to 6. 6	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 16	6. 0 to 6. 6	Moderate.	
100	95 to 100	90 to 100	0. 8 to 2. 5	. 21	5. 8 to 7. 0	Moderate to high.	Subject to flooding for short periods; water table commonly within 3 feet of surface.
100	95 to 100	90 to 100	0. 8 to 2. 5	. 19	6. 6 to 7. 3	Moderate to high.	
100	95 to 100	90 to 100	0. 8 to 2. 5	. 17	6. 6 to 7. 3	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 19	5. 0 to 6. 6	Moderate.	Water table generally at depth of more than 10 feet.
-----------	100	95 to 100	0. 8 to 2. 5	. 18	5. 0 to 5. 8	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 17	6. 0 to 6. 6	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 19	5. 5 to 6. 6	Moderate.	Sand strata below depth of 4 feet in some places.
-----------	100	95 to 100	0. 8 to 2. 5	. 18	5. 0 to 5. 8	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 17	6. 0 to 6. 6	Moderate.	
85 to 95	80 to 90	55 to 65	0. 8 to 2. 5	. 18	6. 0 to 6. 8	Moderate.	Seasonally wet and seepy; scattered pockets of sand and some glacial boulders in till.
85 to 95	80 to 90	50 to 65	0. 2 to 0. 8	. 17	5. 0 to 5. 9	Moderate to high.	
85 to 95	80 to 90	50 to 65	0. 2 to 0. 8	. 16	6. 0 to 7. 0	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 19	5. 2 to 6. 5	Moderate.	Seasonal high water table at or near the surface.
-----------	100	95 to 100	0. 2 to 0. 8	. 18	5. 2 to 6. 0	Moderate to high.	
100	95 to 100	10 to 35	5. 0 to 10. 0	. 04	6. 0 to 6. 8	Low.	Water table generally below depth of 10 feet.
100	95 to 100	8 to 20	5. 0 to 10. 0	. 02	5. 6 to 6. 0	Low.	
-----------	100	95 to 100	0. 8 to 2. 5	. 18	6. 6 to 7. 3	Low.	Loess commonly is calcareous within 2 feet of surface; water table at depth of more than 10 feet.
-----------	100	95 to 100	0. 8 to 2. 5	. 17	6. 6 to 7. 4	Low.	
-----------	100	80 to 95	0. 8 to 2. 5	. 17	7. 4 to 7. 8	Low.	

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Jackson (Ja).	0 to 11	Silt loam	ML or CL	A-4(8) to A-6(12)
	11 to 53	Silty clay loam	CL	A-7-6(11-14)
	53 to 70	Silt loam	CL	A-4(8) to A-6(12)
Judson (JuB).	0 to 38	Silt loam to silty clay loam.	CL or OL	A-6(9) to A-7-6(13)
	38 to 50	Silty clay loam	CL	A-6(10) to A-7-6(12)
Kenyon (KnB, KnC, KnC2, KnD2).	0 to 12	Loam	CL	A-4(8) to A-6(12)
	12 to 51	Loam	CL	A-4(8) to A-6(8)
	51 to 60	Loam	CL	A-4(4) to A-6(10)
Keomah (Ko).	0 to 7	Silt loam	ML or CL	A-6(10) to A-7-6(12)
	7 to 14	Silt loam	ML or CL	A-4(8) to A-6(10)
	14 to 53	Silty clay loam and silty clay.	CL or CH	A-7-6(14-18)
	53 to 63	Silt loam to silty clay loam.	CL	A-6(10) to A-7-6(13)
Keswick (KsD2, KsE2, KsF2, KwD3, KwE3, KwF3).	0 to 13	Loam	CL	A-6(8-12)
	13 to 48	Clay loam and clay	CH or CL	A-7-6(14-18)
	48 to 65	Clay loam	CL	A-6(6-12)
Koszta (Kz).	0 to 14	Silt loam	ML or CL	A-6(8-12)
	14 to 62	Silty clay loam	CL	A-6(12) to A-7-6(14)
Ladoga (LaB, LaC, LaC2, LaD, LaD2, LaE2, LdD3, LdE3).	0 to 10	Silt loam	ML or CL	A-6(10) to A-7-6(14)
	10 to 50	Silty clay loam	CL	A-7-6(14-16)
Ladoga, benches (LbB).	0 to 10	Silt loam	ML or CL	A-6(10) to A-7-6(14)
	10 to 48	Silty clay loam	CL	A-7-6(14-16)
Lamont (Parts of CfC, CfD, CfD2, CfE, CfE2, CfG).	0 to 13	Sandy loam	SM or SC	A-2 or A-4
	13 to 50	Sandy loam	SM or SC	A-2 or A-4
	50 to 60	Loamy sand	SM	A-2-4
Lawler (Le).	0 to 17	Loam	CL or OL	A-6(8-12)
	17 to 41	Loam	CL	A-6(8-12)
	41 to 75	Fine sand	SM or SP	A-2 or A-3
Lawson (Lh and part of An).	0 to 35	Silt loam	CL or OL	A-7-5(10-15)
	35 to 68	Silt loam	CL	A-6(8-12)
	68 to 79	Sandy loam	SM or SC	A-2 or A-4
Lindley (LnD2, LnE2, LnF, LnF2, LnG, LsD3, LsE3, LsF3).	0 to 8	Loam	CL	A-4(3) to A-6(8)
	8 to 37	Clay loam	CL	A-6(9) to A-7-6(14)
	37 to 47	Clay loam	CL	A-6-10(10)

See footnote at end of table.

significant in engineering—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
No. 4	No. 10	No. 200					
			Inches per hour	*Inches per inch of soil*	*pH*		
----------	100	95 to 100	0. 8 to 2. 5	0. 19	5. 6 to 6. 6	Moderate.	Some areas flooded for short periods during high flood stages; seasonal high water table at or near the surface.
----------	100	95 to 100	0. 8 to 2. 5	. 18	5. 6 to 6. 6	Moderate to high.	
----------	100	95 to 100	0. 8 to 2. 5	. 17	6. 0 to 6. 6	Moderate.	
----------	100	90 to 100	0. 8 to 2. 5	. 22	5. 6 to 6. 6	Moderate.	Water table generally below depth of 5 feet; seepy spots in some places.
----------	100	90 to 100	0. 8 to 2. 5	. 19	6. 0 to 6. 6	Moderate.	
95 to 100	80 to 90	55 to 65	0. 8 to 2. 5	. 20	5. 4 to 6. 4	Moderate.	Some gravel and stones in lower part of profile; sand pockets in the till; water table normally at depth of more than 5 feet.
95 to 100	80 to 90	50 to 65	0. 8 to 2. 5	. 18	5. 0 to 6. 2	Moderate.	
95 to 100	80 to 90	50 to 65	0. 8 to 2. 5	. 17	6. 6 to 7. 3	Moderate.	
----------	100	95 to 100	0. 8 to 2. 5	. 18	6. 0 to 6. 6	Moderate.	Seasonal high water table at or near the surface.
----------	100	95 to 100	0. 8 to 2. 5	. 16	5. 0 to 6. 0	Low to moderate.	
----------	100	95 to 100	0. 2 to 0. 8	. 18	5. 0 to 6. 0	High.	
----------	100	95 to 100	0. 2 to 0. 8	. 17	5. 0 to 6. 6	Moderate to high.	
95 to 100	80 to 90	60 to 80	0. 8 to 2. 5	. 17	6. 0 to 6. 6	Moderate.	Seepy line generally occurs upslope, where glacial till contacts loess.
95 to 100	80 to 90	55 to 70	0. 05 to 0. 2	. 16	5. 0 to 6. 0	Moderate to high.	
95 to 100	80 to 90	55 to 70	0. 2 to 0. 8	. 15	6. 0 to 6. 8	Moderate.	
----------	100	95 to 100	0. 8 to 2. 5	. 18	5. 8 to 6. 6	Moderate.	Some areas flooded for short periods during extremely high flood stages; seasonal high water table.
----------	100	95 to 100	0. 2 to 0. 8	. 17	5. 0 to 6. 6	Moderate to high.	
----------	100	95 to 100	0. 8 to 2. 5	. 18	6. 0 to 6. 6	Moderate to high.	Water table generally below depth of 10 feet.
----------	100	95 to 100	0. 2 to 0. 8	. 17	5. 0 to 6. 2	Moderate to high.	
----------	100	95 to 100	0. 8 to 2. 5	. 18	6. 0 to 6. 6	Moderate to high.	Receives local runoff from adjacent higher areas; sandy substratum in places below depth of 4 or 5 feet; water table normally below depth of 10 feet.
----------	100	95 to 100	0. 2 to 0. 8	. 17	5. 6 to 6. 2	Moderate to high.	
100	80 to 90	25 to 50	2. 5 to 5. 0	. 06	5. 0 to 6. 0	Low.	Water table normally at depth of more than 10 feet.
100	80 to 90	25 to 50	2. 5 to 5. 0	. 04	5. 6 to 6. 0	Low.	
100	75 to 90	20 to 35	5. 0 to 10. 0	. 02	5. 0 to 6. 0	Very low.	
95 to 100	80 to 100	55 to 75	0. 2 to 0. 8	. 19	6. 0 to 6. 8	Moderate to high.	Some areas flooded for short periods during extremely high flood stages; seasonal high water table commonly at or near the surface.
95 to 100	80 to 100	55 to 75	0. 2 to 0. 8	. 15	5. 5 to 6. 5	Moderate.	
85 to 95	75 to 90	10 to 35	5. 0 to 10. 0	. 04	5. 5 to 6. 5	Low.	
100	95 to 100	80 to 100	0. 8 to 2. 5	. 22	6. 0 to 6. 8	Moderate to high.	Subject to flooding; thin sandy strata in the subsoil, in some places.
100	95 to 100	80 to 100	0. 8 to 2. 5	. 19	6. 0 to 6. 8	Moderate to high.	
95 to 100	80 to 100	25 to 45	2. 5 to 5. 0	. 10	6. 0 to 6. 8	Low.	
85 to 95	80 to 90	55 to 65	0. 8 to 2. 5	. 17	5. 0 to 6. 5	Moderate.	Scattered pockets of sand or gravel in the till; water table normally below depth of 10 feet.
85 to 95	80 to 90	50 to 65	0. 2 to 0. 8	. 16	5. 0 to 6. 2	Moderate.	
85 to 95	80 to 90	50 to 65	0. 8 to 2. 5	. 16	6. 0 to 6. 8	Moderate.	

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Mahaska (Ma).	0 to 20	Silty clay loam	CL or OL	A-7-6(11-14)
	20 to 49	Silty clay loam	MH or CH	A-7-6(16-20)
	49 to 73	Silt loam	CL	A-7-6(14-16)
Muscatine (Mu).	0 to 17	Silty clay loam	CL or OL	A-7-6(11-14)
	17 to 46	Silty clay loam	CL or CH	A-7-6(15-18)
	46 to 60	Silt loam	CL	A-6(12) to A-7-6(14)
Nevin (Nc).	0 to 20	Silty clay loam	CL or OL	A-6(9) to A-7-6(14)
	20 to 50	Silty clay loam	CL or CH	A-7-6(14-18)
	50 to 60	Silty clay loam	CL	A-6(10) to A-7-6(14)
Nodaway (Nd, Nh, and parts of An and Nx).	0 to 38	Silt loam	ML or CL	A-4(8) to A-6(10)
	38 to 63	Silt loam and silty clay loam.	CL or OL	A-6(10) to A-7-6(12)
Nodaway, silty clay loam substratum (Ns).	0 to 24	Silt loam	ML or CL	A-6(6-10)
	24 to 48	Silty clay loam	OH or CH	A-7-6(12-18)
Otley (OcB, OcC, OcC2, OcD2, OcD3, OcE2).	0 to 13	Silty clay loam	ML or CL	A-6(10) to A-7-6(13)
	13 to 56	Silty clay loam	CL	A-7-6(10-14)
	56 to 68	Silt loam	CL	A-6(10) to A-7-6(14)
Otley, benches (OtB).	0 to 12	Silty clay loam	ML or CL	A-6(10) to A-7-6(13)
	12 to 40	Silty clay loam	CL	A-7-6(10-14)
	40 to 50	Silty clay loam	CL	A-6(10) to A-7-6(14)
Shelby (ShC, ShC2, ShD2, ShE2, ShF2, SoD3, SoE3).	0 to 12	Loam	CL	A-4(8) to A-6(12)
	12 to 35	Clay loam	CL	A-6(11) to A-7-6(14)
	35 to 45	Loam to clay loam	CL	A-6(8) to A-7-6(14)
Sperry (Sp).	0 to 7	Silt loam	ML or CL	A-6(8-10) to A-7-6(12)
	7 to 19	Silt loam	ML or CL	A-6(8-10)
	19 to 50	Silty clay loam	CH	A-7-6(16-20)
	50 to 60	Silt loam to silty clay loam.	CL or CH	A-7-6(12-16)
Stronghurst (Sr).	0 to 13	Silt loam	ML or CL	A-6(8-10)
	13 to 49	Silty clay loam	CL or CH	A-7-6(12-16)
	49 to 57	Silt loam	CL	A-6(10) to A-7-6(13)
Stronghurst, benches (St).	0 to 12	Silt loam	ML or CL	A-6(8-10)
	12 to 50	Silty clay loam	CL or CH	A-7-6(12-16)
	50 to 60	Silt loam	CL	A-6(10) to A-7-6(13)
Taintor (Ta).	0 to 20	Silty clay loam	CL or ML	A-7-6(12-16)
	20 to 47	Silty clay loam	CH	A-7-6(18-20)
	47 to 65	Silty clay loam	CL or CH	A-7-6(14-16)
Tama (TcB, TcC, TcC2, TcD2, TcD3, TcE2, and parts of HgB, HgC, HgC2, HgD2, HgE2).	0 to 15	Silty clay loam	ML or CL	A-6(10) to A-7-5(13)
	15 to 52	Silty clay loam	CL or CH	A-7-6(12-16)
	52 to 67	Silty clay loam	CL	A-6(9-12)

See footnote at end of table.

significant in engineering—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
No. 4	No. 10	No. 200					
			Inches per hour	*Inches per inch of soil*	*pH*		
-----------	100	95 to 100	0.8 to 2.5	0.23	6.0 to 6.8	Moderate to high.	Seasonal high water table normally at or near the surface.
-----------	100	95 to 100	0.2 to 0.8	.20	5.6 to 6.6	High.	
-----------	100	95 to 100	0.2 to 2.5	.17	6.0 to 6.8	Moderate to high.	
-----------	100	95 to 100	0.8 to 2.5	.23	6.0 to 6.8	Moderate to high.	Seasonal high water table normally at or near the surface.
-----------	100	95 to 100	0.2 to 0.8	.20	5.6 to 6.6	High.	
-----------	100	95 to 100	0.8 to 2.5	.17	6.0 to 6.8	Moderate.	
100	95 to 100	80 to 100	0.8 to 2.5	.23	5.8 to 6.6	Moderate to high.	Some areas flooded for short periods during high flood stages; seasonal high water table normally at or near the surface.
100	95 to 100	80 to 100	0.2 to 0.8	.20	5.8 to 6.6	High.	
100	95 to 100	80 to 100	0.2 to 0.8	.17	5.8 to 6.6	Moderate to high.	
100	95 to 100	90 to 100	0.8 to 2.5	.19	6.6 to 7.3	Moderate.	Frequently flooded; water stands in some oxbows and old channels.
100	95 to 100	90 to 100	0.8 to 2.5	.22	6.6 to 7.3	Moderate to high.	
100	95 to 100	90 to 100	0.8 to 2.5	.19	6.6 to 7.3	Moderate.	Frequently flooded; seasonal high water table normally at or near the surface.
-----------	100	95 to 100	0.2 to 0.8	.21	6.6 to 7.3	High.	
-----------	100	95 to 100	0.2 to 2.5	.21	6.0 to 7.3	Moderate.	Water table below depth of 10 feet.
-----------	100	95 to 100	0.2 to 0.8	.19	5.6 to 6.0	Moderate to high.	
-----------	100	95 to 100	0.2 to 2.5	.18	6.0 to 7.3	Moderate to high.	
-----------	100	95 to 100	0.2 to 2.5	.21	6.0 to 7.3	Moderate.	Receives local runoff from adjacent higher areas; water table below depth of 5 feet; sandy substratum at depth of 4 or 5 feet in some places.
-----------	100	95 to 100	0.2 to 0.8	.19	5.6 to 6.0	Moderate to high.	
-----------	100	95 to 100	0.2 to 0.8	.18	6.0 to 7.3	Moderate to high.	
90 to 95	80 to 90	55 to 65	0.8 to 2.5	.19	6.0 to 6.6	Moderate.	Seasonally wet and seepy upslope where till contacts the loess; scattered boulders and pockets of sand in the till.
85 to 95	80 to 90	50 to 65	0.2 to 0.8	.16	5.6 to 6.2	Moderate.	
85 to 95	80 to 90	50 to 65	0.2 to 0.8	.15	6.0 to 7.0	Moderate.	
-----------	100	95 to 100	0.8 to 2.5	.20	6.0 to 6.8	Moderate.	Surface runoff collects in depressions; seasonal high water table ponded in depressions.
-----------	100	95 to 100	0.2 to 0.8	.17	5.0 to 6.0	Moderate.	
-----------	100	95 to 100	0.05 to 0.2	.18	5.0 to 6.0	High.	
-----------	100	95 to 100	0.2 to 0.8	.16	6.0 to 7.0	Moderate to high.	
-----------	100	95 to 100	0.8 to 2.5	.19	5.6 to 6.8	Moderate.	Seasonal high water table at or near the surface.
-----------	100	95 to 100	0.8 to 2.5	.18	5.0 to 6.0	Moderate to high.	
-----------	100	95 to 100	0.8 to 2.5	.16	6.0 to 6.8	Moderate.	
-----------	100	95 to 100	0.8 to 2.5	.19	5.6 to 6.8	Moderate.	Receives water from adjacent uplands.
-----------	100	95 to 100	0.2 to 0.8	.18	5.0 to 6.0	Moderate to high.	
-----------	100	95 to 100	0.8 to 2.5	.16	5.6 to 6.0	Moderate.	
-----------	100	95 to 100	0.2 to 0.8	.23	6.0 to 6.6	Moderate to high.	Seasonal high water table at or near the surface.
-----------	100	95 to 100	0.2 to 0.8	.20	6.0 to 6.6	High.	
-----------	100	95 to 100	0.2 to 0.8	.18	6.8 to 7.5	High.	
-----------	100	95 to 100	0.8 to 2.5	.22	5.8 to 6.8	Moderate.	Water table at depth of 5 to 10 feet, or more.
-----------	100	95 to 100	0.2 to 0.8	.19	5.6 to 6.0	Moderate to high.	
-----------	100	95 to 100	0.8 to 2.5	.17	6.0 to 6.8	Moderate.	

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Tama, benches (ThA, ThB).	0 to 15	Silty clay loam	ML or CL	A-6(10) to A-7-5(13)
	15 to 40	Silty clay loam	CL	A-7-6(12-14)
	40 to 50	Silt loam	CL	A-6(9-12)
Tell (TmB, TmC, TmC2, TmD2).	0 to 10	Silt loam	CL or ML	A-6(9-12)
	10 to 28	Silty clay loam	CL	A-7-6(10-14)
	28 to 38	Loam	CL	A-4(8) to A-6(10)
	38 to 72	Sand	SM or SP	A-2 or A-3
Udolpho (Ud).	0 to 13	Loam	CL	A-6(9-12)
	13 to 34	Loam to clay loam	CL	A-6(7-11)
	34 to 44	Sandy loam	SM or SC	A-2 or A-3
	44 to 49	Loamy fine sand	SM or SC	A-2 or A-3
Wabash (Wa).	0 to 39	Silty clay	OH or CH	A-7-6(18) to A-7-5(20)
	39 to 72	Silty clay	CH	A-7-6(20)
Walford, benches (Wb).	0 to 15	Silt loam	ML-CL	A-6(8-10)
	15 to 47	Silty clay loam	CL or CH	A-7-6(16-20)
	47 to 60	Silt loam	CL	A-7-6(10-14)
Watkins (WkA, WkB).	0 to 12	Silt loam	ML or CL	A-6(6-10)
	12 to 52	Silty clay loam	CL	A-7-6(10-14)
	52 to 65	Silty clay loam	CL	A-7-6(10-14)
Waubeek (WmB, WmC2).	0 to 7	Silt loam	ML or CL	A-6(9-12)
	7 to 29	Silty clay loam	CL	A-7-6(12-16)
	29 to 57	Loam	CL	A-6(6-10)
	57 to 75	Loam	CL	A-6(6-10)
Waukegan (WnA, WnB, WnC, WsB, WsC).	0 to 16	Loam to silt loam	CL or ML	A-4(8) to A-6(10)
	16 to 33	Loam to silty clay loam.	CL	A-4(6) to A-6(12)
	33 to 60	Sand	SM or SP	A-2 or A-3
Wiota (WtA, WtB).	0 to 16	Silt loam	ML or CL	A-6(6-10)
	16 to 45	Silty clay loam	CL	A-7-6(10-14)
	45 to 55	Loam	CL	A-4(6) to A-6(12)
Zook (Zk).	0 to 31	Silty clay loam to silty clay.	MH or CH	A-7-6(16) to A-7-5(20)
	31 to 50	Silty clay to silty clay loam.	CH	A-7-6(16-20)
Zook, overwash (Zo).	0 to 18	Silt loam	ML or CL	A-6(10) to A-7-6(14)
	18 to 48	Silty clay loam to silty clay.	MH or CH	A-7-6(16) to A-7-5(20)
	48 to 60	Silty clay	CH	A-7-6(16-20)

[1] Variable. Classification not possible.

significant in engineering—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
No. 4	No. 10	No. 200					
			Inches per hour	*Inches per inch of soil*	*pH*		
----------	100	95 to 100	0.8 to 2.5	0.22	5.8 to 6.8	Moderate.	Receives runoff from adjacent higher areas; water table below depth of 10 feet.
----------	100	95 to 100	0.8 to 2.5	.19	5.6 to 6.0	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.17	6.0 to 6.8	Moderate.	
----------	100	95 to 100	0.8 to 2.5	.18	5.0 to 6.6	Moderate.	Seasonally seepy areas downslope where glacial till outcrops.
----------	100	95 to 100	0.8 to 2.5	.17	5.0 to 5.5	Moderate to high.	
100	90 to 100	55 to 70	0.8 to 2.5	.15	5.0 to 5.5	Moderate.	
100	90 to 100	5 to 20	5.0 to 10.0	.04	4.5 to 5.5	Low to none.	
100	80 to 100	60 to 80	0.8 to 2.5	.18	6.0 to 6.6	Moderate.	Seasonal high water table at at depth of 2 or 3 feet; some areas subject to flooding during extremely high flood stages.
100	80 to 100	60 to 80	0.8 to 2.5	.17	5.6 to 6.0	Moderate.	
80 to 95	70 to 90	10 to 35	2.5 to 5.0	.10	5.0 to 6.0	Low.	
80 to 95	70 to 90	10 to 35	5.0 to 10.0	.06	5.0 to 6.0	Low.	
100	100	95 to 100	< 0.05	.18	6.0 to 7.0	High.	Subject to flooding; commonly ponded in spring.
100	100	95 to 100	< 0.05	.16	6.6 to 7.3	High.	
----------	100	95 to 100	0.8 to 2.5	.18	6.0 to 6.6	Moderate.	Receives runoff from adjacent higher areas; seasonal high water table at or near the surface.
----------	100	95 to 100	0.2 to 0.8	.17	5.4 to 6.0	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.16	6.0 to 7.0	Moderate.	
----------	100	85 to 95	0.8 to 2.5	.18	5.6 to 6.6	Moderate.	Water table at depth of 5 feet or more.
----------	100	85 to 95	0.2 to 0.8	.17	5.6 to 6.6	Moderate to high.	
----------	100	85 to 95	0.2 to 0.8	.16	5.6 to 6.6	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.20	6.0 to 7.0	Moderate.	A sand layer, as much as 6 inches thick, occurs in many places between the loess and underlying glacial till; this layer contains free water and contributes to seepage that forms on side slopes during wet periods; sand pockets and boulders in till.
----------	100	95 to 100	0.8 to 2.5	.19	5.6 to 6.0	Moderate to high.	
95 to 100	80 to 90	50 to 65	0.8 to 2.5	.16	5.0 to 6.6	Moderate.	
95 to 100	80 to 90	50 to 65	0.8 to 2.5	.15	6.6 to 7.4	Moderate.	
100	95 to 100	70 to 80	0.8 to 2.5	.18	6.0 to 6.6	Moderate.	Water table at depth of 5 feet or more.
100	95 to 100	70 to 80	0.8 to 2.5	.16	5.6 to 6.0	Moderate.	
90 to 100	90 to 95	5 to 20	5.0 to 10.0	.02	5.6 to 6.0	Low to none.	
----------	100	85 to 95	0.8 to 2.5	.20	5.6 to 6.6	Moderate.	Some areas flooded for short periods during extremely high flood stages; water table generally below depth of 5 feet or more.
----------	100	85 to 95	0.8 to 2.5	.18	5.6 to 6.0	Moderate to high.	
----------	100	70 to 90	0.8 to 2.5	.16	5.6 to 6.6	Moderate.	
----------	100	90 to 100	0.05 to 0.2	.19	5.6 to 6.6	High.	Subject to flooding; seasonal high water table at or near the surface.
----------	100	90 to 100	0.05 to 0.2	.18	5.6 to 6.6	High.	
----------	100	85 to 95	0.8 to 2.5	.17	6.0 to 7.0	Moderate.	Frequently flooded; seasonal high water table.
----------	100	90 to 100	0.05 to 0.2	.19	5.6 to 6.6	High.	
----------	100	90 to 100	0.05 to 0.2	.18	5.6 to 6.6	High.	

In soils derived from loess, the seasonal water table generally is above the contact of the loess and the glacial till. In the more nearly level areas, a perched water table occurs in places above the plastic B horizon. In these areas the in-place density of the loess is relatively low, and the moisture content is high. This high moisture content may cause instability in embankments unless it is controlled enough to permit the soil to be compacted to high density.

Because of their high in-place density, soils derived from glacial till generally do not have an excessively high moisture content and are more easily compacted than the soils derived from loess.

Such soils as the Kenyon and Bassett developed from loam till in the northeastern part of the county. These soils are sandy loams and loams and are classified A–4, A–6 (CL). Where this till occurs, sand pockets and sand lenses can be anticipated. Frost heaving is likely if the sand, holding large quantities of free water, is overlain by a fine-grained soil and is within the frost penetration zone. A perched water table may be encountered where a layer or a pocket of sand overlies a layer of clay.

On the nearly level to gently rolling uplands, under a mantle of loess, are the remains of the original Kansan till plain. This glacial till is heterogeneous and of fair quality for construction work. The upper layer is a very plastic clay and is classified A–7–6 (19–20). It is not stable enough to be used for highway subgrades and should not be used in fills that are within 5 feet of the finished grade. On slopes where the loess is thin, this plastic clay crops out, and the Adair soils have formed. If this clay material occurs at grade in roadcuts, it should

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Adair, thin solum (AcD2, AcE2, AeD3, AeE3, AeF3).	Poor	Not suitable	Not suitable	Very poor to depth of about 4 feet; fair or good below depth of 4 feet; large volume change; highly elastic.	Rolling topography; seasonal seepage likely in cuts; difficult to vegetate.	Very slow permeability if compacted; easily compacted at optimum moisture; suitable sites common.
Adair (AaC2, AaD2, AaE2, AdD3, AdE3).	Poor	Not suitable	Not suitable	Not suitable to depth of 4 or 5 feet; should not be used within 5 feet of finished grade; slight to large volume change; slightly elastic.	Rolling topography; seasonally seepy and wet; difficult to vegetate.	Very slow permeability if compacted; easily compacted at optimum moisture; suitable sites common.
Alluvial land (Al)	Good to poor; check each site.	Fair; some areas contain stratified fine sand and medium sand; low in coarse sand or gravel.	Not suitable	Variable; good to not suitable; check each area.	Soil materials variable; subject to frequent flooding; seasonal high water table.	Permeability varies; stratified sand and silt; fluctuating water table; many areas too porous to hold water; suitable sites unlikely.

See footnotes at end of table.

be removed to a depth of 2 feet and should be replaced with a backfill of good glacial till or of coarse-textured soil.

Below the clayey layer is heterogeneous Kansan till that is classified primarily A–6 (CL). This till outcrops on the lower part of slopes and is the parent material of the Gara, Lindley, and Shelby soils. If this till occurs in or along grading projects, it generally is placed in the upper subgrade in unstable areas. Pockets and lenses of sand commonly are interspersed throughout the till and in many places are water bearing. Frost heaving is likely if the road grade is only a few feet above such deposits and the deposits are overlain by loess or loamy till. To prevent frost heaving, these deposits can be drained, or the soil above them can be replaced with a backfill of coarse-textured material or good glacial till.

The soils on bottom lands developed from recent alluvium washed from hills and uplands. Such soils as Colo, Bremer, and Ely have a thick organic surface layer that may consolidate erratically under an embankment load. These soils are classified A–7(CH–CL). They have low in-place density and a high content of moisture. Therefore, if an embankment is to be more than 15 feet in height, these soils should be carefully analyzed to be sure that they are strong enough to support it. Roadways through bottom lands should be constructed on a continuous embankment that extends above the flood level.

Bedrock in Iowa County is at such a depth below the glacial and loessal deposits that it plays no major part in development of the soils.

Included in table 5 are ratings that show the suitability of the soils of the county as a source of topsoil that can be used to promote the growth of vegetation on embankments and cutslopes and as a source of borrow for road construction.

engineering properties of soils

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings [1]
Fair or good stability; moderate or high shrink-swell potential; good for impervious cores.	Wetness caused by seepage; interceptor tile placed above the seepage areas is helpful.	Very slow permeability; subject to erosion; low agricultural value.	Subsoil unfavorable for crop growth; exposed subsoil difficult to vegetate; terrace channels likely to be seepy.	Low fertility; tile needed in many waterways to control seepage.	Severe; very slowly permeable.	Moderate; low compressibility; uneven consolidation; often seepy and wet.
Fair or good stability; high shrink-swell potential; good for impervious cores.	Wetness caused by seepage; interceptor tile placed above the seepage areas is helpful.	Very slow permeability; subject to erosion; low agricultural value.	Subsoil unfavorable; exposed subsoil difficult to vegetate; terrace channels likely to be seepy.	Low fertility; tile needed in many waterways to control seepage.	Severe; very slowly permeable.	Moderate; low compressibility; uneven consolidation; often seepy and wet.
Variable, but generally fairly stable; organic-matter content high in surface layer in some areas.	Variable; subject to frequent flooding; surface drainage beneficial.	Variable moisture-holding capacity; low production potential.	Not needed, because of topography.	Not needed, because of topography.	Severe; subject to frequent flooding; seasonal high water table.	Severe; subject to frequent flooding.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of— Topsoil	Sand	Gravel	Road fill	Soil features affecting— Highway location	Construction of farm ponds: Reservoir area
Amana (Am and part of An).	Good	Not suitable	Not suitable	Fair or poor; poor bearing capacity; poor workability; difficult to compact to high density.	Nearly level topography; seasonal high water table; subject to flooding.	Level topography; fluctuating water table; seepage can be expected even if soil is compacted.
Atterberry (As)	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Fair or poor; fair bearing capacity, but poor shear strength; moderate or high shrink-swell potential.	Seasonal high water table; low borrow potential.	Seepage can be expected even if soil is compacted; sites generally not available.
Atterberry, benches (At)	Fair; only thin layer contains organic matter.	Not suitable to depth of 4 feet; some areas have strata of fine sand below depth of 4 feet.	Not suitable	Fair or poor in uppermost 4 feet; fair bearing capacity but poor shear strength; poor workability when wet.	Seasonal high water table; in places water-bearing sand occurs at depth below 4 feet; low borrow potential.	Coarse strata below depth of 4 feet in some places; rapid seepage rate; suitable sites generally not available.
Bassett (BaC2, BaD2, BaE2, BaF2, BeD3, BeE3).	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Good below depth of about 2 feet; fair or good bearing capacity; easily compacted to high density; moderate volume change with increase in moisture content.	Good source of borrow; easily compacted; seepage likely in some cuts; susceptible to frost action where sand lenses and pockets occur.	Slow permeability if compacted; reservoir bottom should be scarified and compacted; sand and gravel pockets occur in places.
Bertrand (BrA, BrB, BrC2).	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Fair; low bearing capacity when wet; low density material; difficult to compact to high density; unstable when wet.	Fair borrow potential; material easily eroded; need for cuts and fills generally low.	Coarse strata below depth of 4 feet in some places; sites generally not available.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings [1]
Fair stability; high compressibility; fair or poor compaction.	Subject to flooding; tile drains suitable; surface drains needed in some places; flood protection needed.	High available moisture holding capacity; medium intake rate; some areas require drainage and protection from flooding before irrigating.	Not needed, because of topography.	Not needed, because of topography.	Severe; seasonal high water table; subject to flooding, especially in spring.	Severe; subject to flooding; high compressibility.
Fair stability; medium compressibility; fair compaction at optimum moisture; moderate or high expansion potential.	Seasonal high water table; tile functions well; many areas do not require tile drainage.	High available moisture holding capacity; moderate intake rate; some areas may benefit from tiling before irrigating.	Not needed, because of topography.	Not needed, because of topography.	Moderate, unless drained; seasonal high water table.	Moderate; moderate compressibility; uniform consolidation; may lose cohesion and settle if saturated.
Fair stability and compaction; poor resistance to piping in some areas.	Seasonal high water table; tile functions well; many areas do not require tile drainage.	High available moisture holding capacity; moderate intake rate.	Suitable for diversions to protect soils from runoff from adjacent uplands.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Moderate, unless drained; seasonal high water table.	Moderate; moderate compressibility; uniform consolidation; may lose cohesion and settle if saturated.
Easily compacted; adequate strength and stability; low compressibility.	Not needed	High available moisture holding capacity; moderate intake rate; subject to runoff.	Suitable, but cuts should be held to a minimum, generally less than ½ foot to 2 feet; wet spots may develop, but can be drained by tile; subsoil low in fertility.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight or moderate; subsoil moderately slowly permeable.	Slight; good bearing capacity and shear strength; low compressibility; uneven consolidation.
Fair stability and compaction; medium or high compressibility; poor resistance to piping in some areas.	Not needed	High available moisture holding capacity; moderate intake rate; well drained.	Generally not needed; slopes typically are short and irregular.	Suitable	Slight; moderately permeable.	Slight or moderate; medium or high compressibility; fair bearing capacity; may lose cohesion and settle if saturated.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of— Topsoil	Sand	Gravel	Road fill	Soil features affecting— Highway location	Construction of farm ponds: Reservoir area
Bremer (Bs)	Poor	Not suitable	Not suitable	Not suitable; poor bearing capacity, high expansion potential; highly elastic; difficult to compact to high density.	Low borrow potential; seasonal high water table; uppermost 2 feet high in organic-matter content.	Slow permeability if compacted; nearly level topography; suitable sites unlikely.
Bremer, overwash (Bt)	Good in overwash; poor below overwash.	Not suitable	Not suitable	Fair or poor in overwash; not suitable below overwash; poor bearing capacity; high expansion potential; highly elastic.	Low borrow potential; seasonal high water table; high organic-matter content below overwash; subject to local flooding for short periods.	Nearly level topography; slow permeability if compacted; suitable sites unlikely.
Chariton (Ca)	Poor; water table is often high.	Not suitable	Not suitable	Not suitable; poor bearing capacity; high shrink-swell potential; plastic when wet; difficult to compact to high density.	Low borrow potential; high water table; surface layer high in organic-matter content; individual areas small.	Slow permeability; seepage rate low if compacted.
Chelsea (CeB, CeD, CeG, and parts of CfC, CfD, CfD2, CfE, CfE2, CfG).	Poor; low in organic-matter content; droughty.	Suitable; poorly graded fine sand.	Not suitable	Good; low shrink-swell potential; good workability unless fines are less than 15 percent; lacks stability under wheel loads, except when damp.	Highly erodible; difficult to vegetate; loose sand may hinder hauling operations; seepage likely in deep cuts.	Too porous to hold water.
Clinton (ClB, ClC, ClC2, ClD, ClD2, ClE2, ClF2, CnD3, CnE3).	Poor; low in organic-matter content.	Not suitable	Not suitable	Poor; poor shear strength, with fair bearing capacity; moderate or high shrink-swell potential.	Rolling topography; high moisture content likely in deep cuts; low borrow potential.	Slow permeability if compacted; low seepage rate; suitable sites likely.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; high in organic-matter content in uppermost 2 feet; poor workability when wet; high compressibility; high volume change with increase in moisture content.	Seasonal high water table; tile functions satisfactorily in most areas; surface drains beneficial in some areas.	High available moisture holding capacity; moderately slow intake rate; tile needed before irrigating.	Terraces not needed; diversions help to protect soils from overflow from adjacent sloping soils.	Not needed, because of topography.	Severe; seasonal high water table; slowly permeable.	Moderate or severe; high compressibility; high water table; subject to dangerous expansion if initially dry.
High in organic-matter content in uppermost 2 or 3 feet; high compressibility; poor workability when wet; high volume change with increase in moisture content.	Seasonal high water table; tile functions satisfactorily in most areas.	High available moisture holding capacity; moderate intake rate; tile needed before irrigating.	Terraces not needed; diversions help to protect soils from overflow from adjacent uplands.	Not needed, because of topography.	Severe; seasonal high water table; slowly permeable.	Moderate or severe; high compressibility; high water table; subject to dangerous expansion if initially dry.
High shrink-swell potential; medium or high compressibility; difficult to compact.	Seasonal high water table; may need both surface drainage and tile; tile may not drain all areas satisfactorily.	High available moisture holding capacity; slow intake rate; surface drainage needed before irrigating.	Terraces not needed; diversions properly placed on uplands help to protect soils from overflow.	Not needed, because of topography.	Very severe; seasonal high water table; very slowly permeable.	Severe; high compressibility; poor bearing capacity; seasonal high water table.
Highly erodible; low shrink-swell potential; poor resistance to piping; seepage rate high.	Not needed	Low available moisture holding capacity; rapid permeability; low agricultural value.	Highly erodible; difficult to build and maintain terrace ridges and channels.	Highly erodible; low available water holding capacity; difficult to vegetate.	Moderate; poor filtering material; unfiltered sewage will travel long distances.	Slight; low compressibility; fair or good shear strength; rapid consolidation.
Fair stability; poor compaction above optimum moisture content, fair at or below optimum; moderate or high expansion potential.	Not needed	Moderate intake rate; subject to erosion and runoff; high available moisture holding capacity.	Slight limitation on slopes of less than 12 percent; cuts should be held to a minimum to prevent exposure of less productive subsoil.	Seepage on sides of waterways; tile needed to permit establishment of vegetation.	Slight on slopes of less than 10 percent; moderately permeable below depth of 4 feet.	Slight or moderate; poor shear strength; fair bearing capacity; moderate compressibility, but uniform consolidation.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Colo (Co and part of Ct)	Good or fair	Not suitable	Not suitable	Not suitable; high in organic-matter content; moderate or high shrink-swell potential; difficult to compact to high density.	Subject to flooding; seasonal high water table; poor foundation for high fills; low borrow potential.	Nearly level topography; slow permeability if compacted, but high in organic-matter content.
Colo, overwash (Cs)	Good	Not suitable	Not suitable	Poor or unsuitable; high in organic-matter content below depth of 6 to 20 inches; moderate or high shrink-swell potential; difficult to compact.	Subject to flooding; seasonal high water table; poor foundation for high fills; low borrow potential.	Nearly level topography; slow permeability if compacted.
Coppock (Cu)	Fair or good	Not suitable	Not suitable	Fair or poor; fair or poor bearing capacity; moderate or high shrink-swell potential; difficult to compact to high density.	Subject to flooding; seasonal high water table; low borrow potential; surface layer high in organic-matter content.	Slow permeability if compacted, but good sites unlikely.
Dickinson (DcA, DcB, DcC).	Fair or good	Good; poorly graded.	Poor	Good; good workability and compaction; low shrink-swell potential; low compressibility.	Highly erodible; deep cuts likely to be seepy and wet; moderate hazard of frost action through deep cuts; good workability except where fines are less than 15 percent.	Material too porous to hold water.
Dinsdale (DdB, DdC)	Good	Not suitable	Not suitable	Fair in the loess, and good in the till; fair or good bearing capacity; good compaction and workability.	Surface layer high in organic-matter content; seepage occurs in some cuts; hazard of frost action high where sand pockets are encountered.	Slow permeability if compacted; reservoir bottom should be scarified and compacted; sand pockets and lenses occur in places.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
High organic-matter content; moderate or high shrink-swell potential; poor compaction above optimum moisture.	Seasonal high water table; tile functions satisfactorily but good outlets may be difficult to locate; surface drainage beneficial in some areas.	Moderate intake rate; high moisture holding capacity; subject to flooding; needs tile drainage.	Terraces not needed; diversions help to prevent flooding from local runoff.	Not needed, because of topography.	Very severe; seasonal high water table; subject to flooding.	Severe; high compressibility with uneven consolidation; seasonal high water table; subject to flooding.
High organic-matter content below depth of 6 to 20 inches; poor compaction when wet; moderate or high shrink-swell potential.	Seasonal high water table; tile functions satisfactorily; some areas do not require tile if protected from flooding.	Moderate water intake rate; high available moisture holding capacity; subject to flooding.	Terraces not needed; diversions help to prevent flooding from local runoff.	Not needed, because of topography.	Very severe; seasonal high water table; subject to flooding.	Severe; high compressibility with uneven consolidation; subject to flooding; seasonal high water table.
Fair or poor stability; moderate or high shrink-swell potential; poor compaction when wet.	Seasonal high water table; tile functions satisfactorily but diversions are needed in places to prevent local flooding.	Moderate water intake rate; high available moisture holding capacity; tile drainage needed.	Terraces not needed; diversions properly placed help to prevent local flooding and siltation.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Very severe; subject to flooding; seasonal high water table; moderately slowly permeable.	Severe; high compressibility; subject to flooding for short periods; seasonal high water table.
Adequate strength and stability; low shrink-swell potential; moderate permeability even if compacted; susceptible to piping.	Not needed	Low available moisture holding capacity; requires frequent applications of water.	Some limitations; sandy material; difficult to maintain; cuts should be held to a minimum.	Highly erodible; difficult to vegetate.	Slight or moderate; poor filtering material; unfiltered sewage will travel long distances.	Slight; slight compressibility; fair or good shear strength; rapid but possibly uneven consolidation; may liquify and flow if saturated.
Adequate strength and stability; easily compacted below depth of about 2½ feet; moderate expansion potential.	Not needed	Moderate intake rate; high available moisture holding capacity.	Well suited	Seepage on sides of waterways; tile generally needed to permit vegetation to become established.	Slight; moderately permeable.	Slight; good bearing capacity and low compressibility in till; subject to frost action, and to subsequent loss of strength on thawing.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of— Topsoil	Sand	Gravel	Road fill	Soil features affecting— Highway location	Construction of farm ponds: Reservoir area
Downs (DoB, DoC, DoC2, DoD2, DoE2, DsD3, DsE3).	Fair or good; only thin layer contains organic matter.	Not suitable	Not suitable	Fair; fair bearing capacity; fair or good workability; large volume change and loss of bearing capacity when wet.	Rolling topography; high moisture content likely in deep cuts; easy to vegetate; low borrow potential.	Some seepage can be expected; reservoir bottom should be scarified and compacted.
Downs, benches (DpB)	Good	Generally not suitable; poorly graded sand below depth of 4 feet in some places.	Not suitable	Fair in uppermost 4 feet, good below depth of 4 feet; fair or good bearing capacity; fair or good workability.	Low borrow potential; fairly stable and easy to vegetate.	Coarse strata encountered below depth of 4 feet in some places; reservoir bottom should be scarified and compacted.
Ely (EsB and parts of Ct and Nx).	Good	Not suitable	Not suitable	Poor; moderate or high expansion potential; poor bearing capacity; difficult to compact to high density.	High in organic-matter content; seasonal high water table; subject to local flooding for short periods.	Coarse-textured layer occurs in places below depth of 4 feet; reservoir bottom should be scarified and compacted.
Fayette (FaB, FaC, FaC2, FaD, FaD2, FaE, FaE2, FaF, FaF2, FaG, FsD3, FsE3, FsF3, and parts of CfC, CfD, CfD2, CfE, CfE2, CfG).	Poor; only thin layer contains organic matter.	Not suitable	Not suitable	Fair; fair bearing capacity; fair or good workability; low density material; narrow range of moisture content for satisfactory compaction.	Rolling topography; fairly stable; easy to vegetate; water table may be encountered in deep cuts; low borrow potential.	Some seepage can be expected; reservoir bottom should be scarified and compacted.
Fayette, benches (FbB)	Poor; only thin layer contains organic matter.	Generally not suitable; poorly graded sand below depth of 4 feet in some places.	Not suitable	Fair; good below depth of 4 feet if sand is encountered; fair bearing capacity above 4 feet; low density material in upper horizon.	Low borrow potential in uppermost 4 feet; fair stability; easy to vegetate except where coarse strata occur.	Coarse strata below depth of 4 feet in some places; reservoir bottom should be scarified and compacted.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; compacts readily at optimum moisture; poor compaction above optimum moisture; medium or high compressibility.	Not needed	Moderate intake rate; high available moisture holding capacity; erosion control practices needed.	Well suited on slopes of less than 12 percent.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight on slopes of less than 10 percent.	Moderate; medium or high compressibility; uniform consolidation; fair or poor bearing capacity.
Fair stability; compacts readily at optimum moisture; poor resistance to piping in places.	Not needed	Moderate intake rate; high available moisture holding capacity.	Terraces suitable; diversions where needed above benches help to protect soils from local runoff.	Well suited	Slight, moderately permeable.	Moderate; medium or high compressibility; uniform consolidation; fair or poor bearing capacity.
Adequate strength and stability; moderate or high expansion potential; good compaction at or near optimum moisture.	Wetness caused by seepage; interceptor tile needed.	Moderate intake rate; high available moisture holding capacity; favorable production potential.	Terraces not needed; diversions properly placed help to protect from overflow; terraces not needed.	Seepage on sides of drainageways; tile needed to permit vegetation to become established.	Moderate or severe; seasonal high water table.	Severe; fair or poor bearing capacity; moderate or high compressibility; subject to local flooding for short periods.
Fair stability; high compressibility; fair compaction at or near optimum moisture but poor above optimum; moderate shrink-swell potential.	Not needed	Moderate intake rate; high available moisture holding capacity; subject to erosion.	Suitable on slopes of less than 12 percent.	Seepage on sides of drainageways; tile generally needed to permit vegetation to become established.	Slight on slopes of less than 10 percent; moderately permeable.	Moderate; medium or high compressibility; uniform consolidation; fair bearing capacity.
Fair stability; high consolidation; fair compaction at or near optimum moisture; poor resistance to piping.	Not needed	Moderate intake rate; moderate or high available moisture holding capacity.	Terraces suitable; diversions where needed above benches help to protect soils from local runoff.	Well suited	Slight; moderately permeable.	Slight or moderate; medium or high compressibility to depth of 4 feet, low below depth of 4 feet; uniform consolidation.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Gara (GaC2, GaD2, GaE2, GaF2, GrD3, GrE3, GrF3).	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Good; fair or good bearing capacity; good workability and compaction; easily compacted to high density.	Rolling topography; soil material variable in cuts; some cuts likely to be seepy; good borrow potential.	Slow permeability if compacted; suitable sites likely.
Givin (Gs)	Fair	Not suitable	Not suitable	Very poor; low bearing capacity when wet; poor shear strength; difficult to compact to high density.	Seasonal high water table; low borrow potential; poor workability when wet; nearly level topography.	Slow permeability if compacted; suitable sites unlikely.
Gullied land (Gu)[2]						
Hagener (HaA, HaB, HaC, HaD, HaE, and parts of HgB, HgC, HgC2, HgD2, HgE2).	Poor	Suitable; sand is fine grained and poorly graded.	Not suitable	Good; low shrink-swell potential; good bearing capacity; good workability unless fines are less than 15 percent.	Highly erodible; seepage may occur in some deep cuts; difficult to vegetate; loose sand may hinder hauling operations.	Material too porous to hold water.
Hopper (HoD2, HoE2, HoE3, HoF2).	Fair	Not suitable	Not suitable	Fair or poor; fair bearing capacity and shear strength; fair workability and compaction; narrow moisture range for suitable compaction.	Rolling topography; highly erodible; seepage may occur in some deep cuts; low borrow potential.	Material too porous to hold water; sealer needed to prevent excess seepage.
Jackson (Ja)	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Fair or poor; fair bearing capacity; poor compaction above optimum moisture; moderate or high expansion potential.	Seasonal high water table; nearly level topography; low borrow potential.	Coarse strata in some places; reservoir bottom should be scarified and compacted; suitable sites unlikely.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Adequate stability; easily compacted to high density; good workability; good for cores.	Seasonally seepy; interceptor tile helps to control seepage at contact of loess and till.	High rate of runoff; subject to erosion; high available moisture holding capacity; erosion control practices needed.	Suitable on slopes of less than 12 percent; cuts should be held to a minimum because of less productive subsoil.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Moderate on slopes of less than 10 percent; moderately slowly permeable.	Slight; good bearing capacity and shear strength; low compressibility; uneven consolidation.
Fair stability; moderate or high shrink-swell potential; poor compaction when wet.	Seasonal high water table; tile functions satisfactorily; surface drains beneficial in depressions.	Somewhat poorly drained; high available moisture holding capacity; tile drainage needed.	Not needed, because of topography.	Not needed, because of topography.	Severe, unless tile drained; seasonal high water table; moderately slowly permeable.	Moderate or severe; moderate or high compressibility; uniform consolidation; seasonal high water table.
Seepage rate high; highly erodible; low shrink-swell potential; poor resistance to piping.	Not needed	Low available moisture holding capacity; rapid permeability.	Highly erodible; difficult to build and maintain terrace ridges and channels; suitability questionable.	Highly erodible; low moisture holding capacity; difficult to vegetate.	Moderate; rapidly permeable; poor filtering material; unfiltered sewage will travel long distances.	Slight; low compressibility; fair or good shear strength; rapid consolidation; negligible volume change on wetting; may liquify if excavated when wet.
Fair stability; fair compaction at or below optimum moisture, but poor above optimum; medium or high compressibility; low shrink-swell potential.	Not needed	Medium available moisture holding capacity; medium intake rate; high rate of runoff; subject to erosion.	Suitable on slopes of less than 12 percent.	Highly erodible; vegetation difficult to establish and maintain.	Slight on slopes less than 10 percent.	Slight or moderate; medium or high compressibility; uniform consolidation; fair bearing capacity.
Fair stability; medium or high compressibility; moderate or high shrink-swell potential.	Seasonal high water table; tile functions satisfactorily; not all areas require tile.	Moderate intake rate; high available moisture holding capacity.	Not needed, because of topography.	Generally not needed, because of topography.	Moderate; seasonal high water table.	Moderate; medium or high compressibility; fair bearing strength; seasonal high water table; may liquify if excavated when wet.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Judson (JuB)	Excellent	Not suitable	Not suitable	Not suitable; high in organic-matter content in uppermost 2 or 3 feet; fair or poor bearing capacity; difficult to compact to high density.	Subject to flooding by local runoff; seepy in some places; low borrow potential; high in organic-matter content.	Reservoir bottom should be scarified and compacted.
Kenyon (KnB, KnC, KnC2, KnD2).	Good	Not suitable	Not suitable	Good in till at depth of 2 feet; fair above the till; fair or good bearing capacity; easily compacted to high density.	Good sources of borrow; surface layer high in organic-matter content; highly susceptible to frost action; seepage likely in some cuts.	Sand pockets occur in places; reservoir bottom should be scarified and compacted.
Keomah (Ko)	Fair; low in organic-matter content.	Not suitable	Not suitable	Poor; high shrink-swell potential; low bearing capacity when wet; difficult to compact to high density.	Seasonal high water table; poor workability and compaction when wet; low borrow potential.	Uniform material; slow permeability if compacted; good sites unlikely.
Keswick (KsD2, KsE2, KsF2, KwD3, KwE3, KwF3).	Poor	Not suitable	Not suitable	Very poor to a depth of about 4 feet; good below depth of 4 feet; high shrink-swell potential; high density material.	Rolling topography; seepage likely in some cuts; highly susceptible to frost action where sand pockets occur; difficult to establish vegetation on slopes.	Slow permeability; seepage will be low.
Koszta (Kz)	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Poor; fair or poor bearing capacity and shear strength; poor compaction when wet; moderate or high shrink-swell potential.	Seasonal high water table; low borrow potential; subject to occasional overflow.	Reservoir bottom should be scarified and compacted.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; high compressibility; moderate expansion potential; fair compaction at optimum moisture.	Seasonally seepy; most areas do not need tile; interceptor tile needed in seepy areas.	High available moisture holding capacity; moderate intake rate; yield potential favorable.	Terraces not needed; diversions help to protect soils from local overflow.	Well suited; tile helpful in controlling seepage when vegetation is established.	Slight or moderate; periodic overflow may cause damage to filter fields.	Moderate; high compressibility; fair or poor bearing capacity and shear strength.
Adequate strength and stability; good compaction characteristics; low compressibility; good for cores.	Not needed	Moderate intake rate; high available moisture holding capacity.	Suitable, but cuts should be held to a minimum, generally less than 2 feet; wet spots may develop but can be drained by tile.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight or moderate on slopes of less than 10 percent.	Slight; good bearing capacity and shear strength; low compressibility; uneven consolidation in some places.
Fair stability; high shrink-swell potential; difficult to compact to high density when wet.	Seasonal high water table; tile functions satisfactorily; some areas do not require tile.	Moderate intake rate; moderately slow permeability; high available moisture holding capacity.	Not needed, because of topography.	Not needed, because of topography.	Severe; moderately slowly permeable; seasonal high water table.	Moderate or severe; poor bearing capacity; moderate or high compressibility; uniform consolidation; high water table.
Good stability; can be used for impervious core; moderate or high shrink-swell potential; good compaction at or near optimum moisture.	Wetness because of seepage; interceptor tile needed at contact of loess and till.	High available moisture holding capacity; slow or very slow permeability; subject to runoff; low production potential.	Subsoil unfavorable; terrace channels may be wet and seepy; cuts should be held to a minimum; slopes commonly greater than 12 percent.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Severe; slowly to very slowly permeable; seasonally wet and seepy.	Slight or moderate; low compressibility; good bearing capacity below depth of 4 feet; highly expansive if subject to wide fluctuation in moisture.
Low stability when wet; difficult to compact to high density; moderate or high compressibility.	Seasonal high water table; tile functions satisfactorily.	Moderate intake rate; moderate permeability; high available moisture holding capacity.	Not needed, because of topography.	Not needed, because of topography.	Moderate; seasonal high water table.	Moderate or severe; moderate or high compressibility; seasonal high water table.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—: Topsoil	Suitability as source of—: Sand	Suitability as source of—: Gravel	Suitability as source of—: Road fill	Soil features affecting—: Highway location	Soil features affecting—: Construction of farm ponds: Reservoir area
Ladoga (LaB, LaC, LaC2, LaD, LaD2, LaE2, LdD3, LdE3).	Fair or poor; only thin layer contains organic matter.	Not suitable	Not suitable	Poor; fair bearing capacity; poor shear strength; moderate or high shrink-swell potential.	Rolling topography; high moisture content in some deep cuts; low borrow potential.	Reservoir bottom of uniform material; slow permeability if compacted.
Ladoga, benches (LbB)	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Poor; fair bearing capacity; poor shear strength; moderate or high shrink-swell potential.	Gently sloping topography; subject to flooding by local runoff from adjacent slopes; low borrow potential.	Reservoir bottom of uniform material; slow permeability if compacted; sand strata below depth of 4 feet in some places.
Lamont (Parts of CfC, CfD, CfD2, CfE, CfE2, CfG).	Fair; only thin layer contains organic matter.	Good; poorly graded.	Not suitable	Good; good workability and compaction; low shrink-swell potential; low compressibility.	Highly erodible; good workability, except where fines are less than 15 percent; deep cuts likely to be seasonally seepy.	Material too porous to hold water.
Lawler (Le)	Excellent	Suitable below depth of 30 to 45 inches; poorly graded.	Not suitable	Very poor in upper part, good in lower part; moderately high shrink-swell potential; low density material; high in organic-matter content; substratum has low compressibility and volume change on wetting.	Highly susceptible to frost action; seasonal high water table; water-bearing sands occur in places in substratum; surface layer high in organic-matter content.	Sand strata below depth of 30 to 45 inches; reservoir bottom should be scarified and compacted.
Lawson (Lh and part of An).	Excellent	Not suitable	Not suitable	Very poor; low density material; moderate or high shrink-swell potential; fair bearing capacity and shear strength; low stability at high moisture content.	Subject to flooding; seasonal high water table; low borrow potential.	Seepage can be expected; sand strata in some places; fluctuating water table; reservoir bottom should be scarified and compacted.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; poor compaction above optimum moisture; moderate or high shrink-swell potential.	Generally not needed.	Moderate intake rate; high available moisture holding capacity; subject to erosion.	Suitable on slopes of less than 12 percent.	Seepage on sides of drainageways; tile generally needed to permit vegetation to become established.	Slight or moderate on slopes of less than 10 percent.	Moderate; fair bearing capacity; poor shear strength; moderate compressibility; uniform consolidation.
Fair stability; poor compaction above optimum moisture; moderate or high shrink-swell potential.	Not needed	Moderate intake rate; high available moisture holding capacity.	Subject to flooding by local runoff; diversions, placed upslope from benches, help to protect soils from runoff.	Suitable	Slight or moderate.	Moderate; fair bearing capacity; moderate compressibility; uniform consolidation.
Adequate strength and stability; low shrink-swell potential; susceptible to piping.	Not needed	Low available moisture capacity; requires frequent applications of water.	Sandy material difficult to maintain; cuts should be held to a minimum.	Highly erodible; difficult to vegetate.	Slight or moderate; poor filtering material; unfiltered sewage will travel long distances.	Slight; slight compressibility; fair to good shear strength; rapid but possibly uneven consolidation; may liquify and flow if saturated.
Adequate strength and stability; high organic-matter content in upper part; poor resistance to piping.	Seasonal high water table; tile functions satisfactorily; not all areas need tile.	Moderate intake rate; moderate permeability to depth of 30 to 45 inches; moderate available moisture holding capacity.	Not needed, because of topography.	Not needed, because of topography.	Moderate or severe; seasonal high water table; subject to occasional flooding.	Moderate or severe; subject to occasional flooding; medium or high compressibility in upper part; low compressibility in substratum; highly susceptible to frost action.
Adequate strength and stability; difficult to compact to high density; high organic-matter content; subject to piping.	Seasonal high water table; tile functions well; some areas need protection from flooding.	High available moisture holding capacity; may require drainage before irrigating.	Terraces not needed; diversions, properly placed, help to reduce wetness.	Not needed, because of topography.	Severe; seasonal high water table; subject to overflow.	Moderate or severe; moderate or high compressibility; uneven consolidation; subject to flooding; may liquify if saturated.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Lindley (LnD2, LnE2, LnF, LnF2, LnG, LsD3, LsE3, LsF3).	Poor	Not suitable	Not suitable	Good; fair or good bearing capacity; low compressibility; easily compacted to high density.	Rolling and steep topography; good source of borrow; some cuts are seepy; surface layer low in organic-matter content.	Slow permeability; good sites likely.
Mahaska (Ma)	Excellent	Not suitable	Not suitable	Not suitable; poor bearing capacity and shear strength; moderate or high shrink-swell potential; highly elastic and difficult to compact to high density.	Nearly level topography; uppermost 1½ feet high in organic-matter content; seasonal high water table; low borrow potential.	Slow permeability if compacted; uniform material; suitable sites unlikely.
Muscatine (Mu)	Excellent	Not suitable	Not suitable	Not suitable; fair bearing capacity and poor shear strength; moderate or high shrink-swell potential; highly elastic.	Nearly level topography; uppermost 1½ feet high in organic-matter content; seasonal high water table; low borrow potential.	Slow permeability if compacted; uniform material; suitable sites unlikely.
Nevin (Nc)	Excellent	Not suitable	Not suitable	Not suitable; poor bearing capacity and shear strength; moderate or high shrink-swell potential; highly elastic and difficult to compact to high density.	Nearly level topography; uppermost 1½ feet high in organic-matter content; seasonal high water table; low borrow potential.	Slow permeability if compacted.
Nodaway (Nd, Nh, and parts of An and Nx).	Excellent	Not suitable	Not suitable	Not suitable; poor bearing capacity and shear strength; low density material; difficult to compact to high density.	Nearly level topography; subject to frequent overflow; layer below depth of about 3 feet high in organic-matter content; low borrow potential.	Some seepage can be expected; reservoir area needs to be compacted.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued: Construction of farm ponds—Con.: Embankment	Soil features affecting—Continued: Agricultural drainage	Soil features affecting—Continued: Irrigation	Soil features affecting—Continued: Terraces and diversions	Soil features affecting—Continued: Waterways	Degree of limitation for—: Septic tank fields	Degree of limitation for—: Foundations for low buildings [1]
Good stability; easily compacted to high density; can be used for core material; low permeability if compacted.	Generally not needed; interceptor tile may be useful to control seepy spots at contact of loess and till.	High available moisture holding capacity; high rate of runoff; low natural fertility.	Slopes generally are stronger than 12 percent and commonly are irregular and steep; subsoil low in fertility.	Seepage on sides of waterways; tile generally needed to permit vegetation to become established.	Severe; slopes exceed 10 percent.	Slight; fair or good bearing capacity and shear strength; low compressibility; uneven consolidation.
Fair stability; high shrink-swell potential; plastic when wet; poor compaction above optimum moisture; moderate or high expansion potential.	Seasonal high water table; tile functions satisfactorily; some areas do not need tile.	Moderate intake rate; high available moisture holding capacity; favorable production potential.	Not needed, because of topography.	Not needed, because of topography.	Moderate or severe; seasonal high water table; moderately slowly permeable.	Moderate; high compressibility; uniform consolidation; poor bearing capacity and shear strength; expands if subject to wide fluctuation in moisture content.
Fair stability; fair compaction at optimum moisture, but poor above optimum; moderate or high shrink-swell potential.	Seasonal high water table; tile functions satisfactorily; many areas do not need tile.	Moderate intake rate; high available moisture holding capacity; favorable production potential.	Not needed, because of topography.	Not needed, because of topography.	Moderate; seasonal high water table.	Moderate; moderate or high compressibility; uniform consolidation; fair bearing capacity.
Fair stability; poor compaction above optimum moisture; moderate or high shrink-swell potential.	Seasonal high water table; tile functions satisfactorily; some areas do not need tile.	Moderate intake rate; high available moisture holding capacity; favorable production potential.	Not needed, because of topography.	Not needed, because of topography.	Moderate or severe; seasonal high water table.	Moderate or severe; moderate or high compressibility; poor bearing capacity; subject to occasional flooding; seasonal high water table.
Low stability at high moisture content; poor compaction above optimum moisture; suitable for shell but not for core.	Seasonally wet because of flooding; most areas do not need tile; protection from overflow needed in places.	Moderate intake rate; high available moisture holding capacity; subject to flooding.	Not needed, because of topography.	Generally not needed, because of topography; well suited where needed.	Severe; subject to frequent flooding.	Severe; high compressibility; even consolidation; subject to frequent flooding; low bearing capacity.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of— Topsoil	Sand	Gravel	Road fill	Soil features affecting— Highway location	Construction of farm ponds: Reservoir area
Nodaway, silty clay loam substratum (Ns).	Excellent	Not suitable	Not suitable	Not suitable; poor bearing capacity and shear strength; high shrink-swell potential below depth of 20 to 36 inches.	Nearly level topography; subject to frequent overflow; layer below depth of 20 to 36 inches high in organic-matter content; low borrow potential.	Moderate or slow permeability if compacted; good sites not likely; reservoir area needs to be compacted.
Otley (OcB, OcC, OcC2 OcD2, OcD3, OcE2).	Good	Not suitable	Not suitable	Poor; fair bearing capacity; poor shear strength; moderate or high shrink-swell potential.	Rolling topography; surface layer moderate or high in organic-matter content; high moisture content in some deep cuts; cuts easily vegetated.	Reservoir bottom of uniform material; slow permeability if compacted.
Otley, benches (OtB)	Good	Not suitable	Not suitable	Poor; fair bearing capacity; poor shear strength; moderate or high shrink-swell potential.	Receives local runoff; moderate or high in organic-matter content; low borrow potential.	Slow permeability if compacted; sand strata below depth of 4 feet in some places.
Shelby (ShC, ShC2, ShD2, ShE2, ShF2, SoD3, SoE3).	Fair	Not suitable	Not suitable	Good; fair or good bearing capacity; low compressibility; good workability and compaction; easily compacted to high density.	Rolling topography; soil material variable in cuts; some cuts likely to be seepy; good borrow potential.	Slow permeability if compacted; suitable sites likely.
Sperry (Sp)	Poor; high water table.	Not suitable	Not suitable	Not suitable; poor bearing capacity; moderate or high shrink-swell potential; poor workability; highly elastic.	Depressed topography; high water table; surface layer moderately high in organic-matter content; individual areas 1 or 2 acres in size.	Depressed topography; slow permeability if compacted; suitable sites unlikely.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Low stability at high moisture; poor workability and compaction above optimum moisture; moderate or high shrink-swell potential.	Seasonally wet because of flooding; tile functions satisfactorily; protection from overflow needed in many places.	Moderate intake rate; high available moisture holding capacity; subject to flooding.	Not needed, because of topography.	Generally not needed, because of topography; well suited where needed.	Severe; subject to frequent flooding.	Severe; high compressibility; even consolidation; subject to frequent flooding; low bearing capacity.
Fair stability; poor compaction above optimum moisture, but fair at or below optimum; moderate or high shrink-swell potential.	Not needed	Moderate intake rate; high available moisture holding capacity; subject to erosion; favorable production potential.	Suitable on slopes of less than 12 percent.	Seepage on sides of waterways; tile generally needed to permit vegetation to become established.	Slight on slopes of less than 10 percent; moderately permeable below depth of 4 feet.	Moderate; moderate compressibility; uniform consolidation; fair bearing capacity; expands if subject to wide fluctuation in moisture content.
Fair stability; poor compaction above optimum moisture, good at or below optimum; moderate or high shrink-swell potential.	Not needed	Moderate intake rate; high available moisture holding capacity; favorable production potential.	Soil properties suitable; diversions help to protect soils from local runoff.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight or moderate; moderately slowly permeable.	Moderate; moderate compressibility; uniform consolidation; fair bearing capacity.
Adequate stability; easily compacted to high density; good workability; suitable for core.	Seasonally seepy; interceptor tile helpful in places to control seepage at contact of loess and till.	Subject to erosion; high available moisture holding capacity.	Suitable on slopes of less than 12 percent; cuts should be held to a minimum because of less productive subsoil.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Moderate on slopes of less than 10 percent; moderately slowly permeable.	Slight; good bearing capacity and shear strength; low compressibility; uneven consolidation.
Fair or poor stability; moderate or high shrink-swell potential; poor workability when wet.	Seasonal high water table; tile not suitable in all areas; surface drains needed to remove ponded water.	High available moisture holding capacity; drainage needed before irrigating.	Not needed, because of topography.	Not needed, because of topography.	Severe; high water table; slowly permeable.	Severe; poor bearing capacity; moderate or high compressibility; uniform consolidation; high water table.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Stronghurst (Sr)	Poor	Not suitable	Not suitable	Fair; fair bearing capacity; moderate or high shrink-swell potential; low stability when wet.	Nearly level topography; seasonal high water table; low borrow potential.	Seepage can be expected; reservoir bottom should be scarified and compacted.
Stronghurst, benches (St)	Poor	Not suitable	Not suitable	Fair; fair bearing capacity; moderate or high shrink-swell potential; low stability when wet.	Nearly level topography; receives runoff from adjacent higher areas; seasonal high water table.	Coarse strata below depth of 4 feet in some places; reservoir bottom should be scarified and compacted.
Taintor (Ta)	Fair	Not suitable	Not suitable	Not suitable; elastic; fair bearing capacity; poor shear strength; moderate or high shrink-swell potential; difficult to compact to high density.	Nearly level topography; uppermost 1 or 2 feet high in organic-matter content; seasonal high water table; low borrow potential.	Slow permeability if compacted; suitable sites unlikely.
Tama (TcB, TcC, TcC2 TcD2, TcD3, TcE2, and parts of HgB, HgC, HgC2, HgD2, HgE2).	Excellent	Not suitable	Not suitable	Fair; fair bearing capacity; moderate shrink-swell potential.	Rolling topography; uppermost layer high in organic-matter content; high moisture content in deep cuts; easy to vegetate cuts; low borrow potential.	Seepage can be expected; reservoir bottom should be scarified and compacted.
Tama, benches (ThA, ThB).	Excellent	Not suitable; poorly graded sand in some places below depth of 45 inches.	Not suitable	Fair or good in subsoil; fair or good bearing capacity; moderate shrink-swell potential; substratum good; low volume change on wetting.	Upper layers high in organic-matter content; easy to vegetate, except where coarse strata are encountered.	Coarse strata below depth of 45 inches in some places; reservoir bottom should be scarified and compacted.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; poor compaction above optimum moisture, fair at or below optimum.	Seasonal high water table; tile functions satisfactorily; not needed in all areas.	Moderate intake rate; high available moisture holding capacity.	Not needed, because of topography.	Not needed, because of topography.	Moderate; seasonal high water table.	Slight or moderate; medium or high compressibility; uniform consolidation.
Fair stability; poor compaction above optimum moisture, fair at or below optimum.	Seasonal high water table; tile functions satisfactorily; not needed in all areas.	Moderate intake rate; high available moisture holding capacity.	Terraces not needed; diversions help to intercept runoff from higher areas.	Not needed, because of topography.	Moderate; seasonal high water table.	Slight or moderate medium or high compressibility; uniform consolidation.
Fair stability; poor compaction when wet; moderate or high shrink-swell potential.	Seasonal high water table; tile functions satisfactorily if properly spaced.	High available moisture holding capacity; moderately slow intake rate; drainage needed before irrigating; favorable production potential.	Not needed, because of topography.	Not needed, because of topography.	Severe; seasonal high water table.	Moderate; medium compressibility; fair bearing capacity; uniform consolidation; subject to large volume change with increase in moisture content.
Fair stability; fair or poor compaction above optimum moisture content, good at or below optimum.	Not needed	Moderate intake rate; high available moisture holding capacity; favorable production potential.	Well suited on slopes of less than 12 percent.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight on slopes of less than 10 percent.	Moderate; medium or high compressibility; uniform consolidation; subject to large volume change with increase in moisture content.
Fair stability; good compaction at or below optimum moisture; poor resistance to piping in places.	Not needed	Moderate intake rate; moderate or high available moisture holding capacity; favorable production potential.	Well suited; diversions help to intercept runoff from higher areas.	Suitable	Slight	Slight or moderate; medium or high compressibility above coarse strata; uniform consolidation.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Tell (TmB, TmC, TmC2, TmD2).	Fair	Suitable; poorly graded fine sand and medium sand below depth of 24 to 40 inches.	Not suitable	Fair or good; fair bearing capacity in upper part, good in substratum; low volume change with increase in moisture content; good stability if combined.	Rolling topography; loose sand at depth of 24 to 40 inches; free water likely in deep cuts; highly susceptible to frost action.	Too porous to hold water.
Udolpho (Ud)	Good	Suitable; poorly graded sand below depth of 30 to 50 inches.	Not suitable	Fair in uppermost 30 to 50 inches; moderate volume change and loss of bearing capacity when wet; good in substratum; little or no volume change on wetting; good stability if combined.	Nearly level or gently sloping topography; seasonal high water table; highly susceptible to frost action; good borrow potential.	Too porous to hold water; fluctuating water table.
Wabash (Wa)	Not suitable	Not suitable	Not suitable	Not suitable; poor bearing capacity; high shrink-swell potential; highly elastic; difficult to compact to high density.	Surface layer high in organic-matter content; high water table; subject to flooding; low borrow potential.	Level topography; subject to flooding; slow permeability; suitable sites unlikely.
Walford, benches (Wb)	Fair to poor; high water table.	Not suitable	Not suitable	Not suitable; poor bearing capacity; moderate or high shrink-swell potential; highly elastic.	Depressed topography; low borrow potential; high water table.	Depressed topography; suitable sites unlikely.
Watkins (WkA, Wkb)	Fair to good	Not suitable	Not suitable	Poor; fair bearing capacity and shear strength; moderate or high shrink-swell potential; low stability when wet.	Nearly level or gently sloping topography; low borrow potential.	Some areas too porous to hold water; reservoir bottom should be scarified and compacted.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings [1]
Fair stability; fair or good compaction; rapid seepage rate; poor resistance to piping.	Not needed	Moderate intake rate; moderate or low available moisture holding capacity.	Suitable, but cuts should be held to a minimum to prevent exposure of coarse-textured substratum.	Vegetation difficult if coarse strata are exposed.	Slight or moderate; poor filtering material below depth of 24 to 40 inches.	Slight; low or medium compressibility; fair or good bearing capacity.
Fair stability; fair or good compaction; moderate or low shrink-swell potential; poor resistance to piping.	Seasonal high water table; tile functions satisfactorily; some areas do not require tile.	Moderate intake rate; moderate or low available water holding capacity.	Not needed, because of topography.	Not needed, because of topography.	Moderate; seasonal high water table; poor filtering material below depth of 30 to 50 inches.	Moderate; low or medium compressibility; seasonal high water table; good bearing capacity but may liquify and flow if excavated when wet.
Fair stability on flat slopes; poor compaction and workability; high shrink-swell potential.	High water table; surface ditches needed across predominant slopes.	Water intake rate varies with amount of vertical cracking; high available moisture holding capacity; difficult to drain adequately.	Not needed, because of topography.	Not needed, because of topography.	Very severe; very slowly permeable and high water table.	Severe; poor bearing capacity and shear strength; medium or high compressibility; subject to dangerous expansion if initially dry.
Poor stability when wet; poor compaction except at optimum moisture; moderate or high expansion potential.	Seasonal high water table; tile may not drain all areas satisfactorily; surface drains beneficial.	High available moisture holding capacity; slow permeability; difficult to drain adequately.	Terraces not needed; diversions help to protect soils from runoff from higher areas.	Not needed, because of topography.	Very severe; high water table.	Severe; poor bearing capacity; moderate compressibility; uniform consolidation; high water table.
Fair stability; poor compaction above optimum moisture; moderate or high shrink-swell potential.	Not needed	Moderate intake rate; high available moisture holding capacity; favorable production potential.	Terraces not needed; diversions help to protect soils from runoff from higher areas.	Not needed, because of topography.	Slight	Slight; moderate or high compressibility; fair bearing capacity.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Waubeek (WmB, WmC2)	Fair to good	Not suitable	Not suitable	Fair in the loess; good in the till; fair or good bearing capacity; moderate volume change with increase in moisture content.	Seepage likely in cuts; highly susceptible to frost action where sand pockets and strata occur.	Sand pockets and lenses occur in places; reservoir bottom should be scarified and compacted.
Waukegan (WnA, WnB, WnC, WsB, WsC).	Good	Good; poorly graded sand below depth of 30 to 45 inches.	Poor; generally very small amounts of gravel below depth of 30 to 45 inches.	Fair or poor in uppermost 30 to 40 inches; good in substratum; good bearing capacity and shear strength in coarse strata; low volume change on wetting.	Coarse strata highly erodible in exposed cuts; surface layer high in organic-matter content; good borrow potential.	Too porous to hold water.
Wiota (WtA, WtB)	Good	Not suitable	Not suitable	Poor to fair in lower part of strata; fair bearing capacity; moderate to high shrink-swell potential.	Nearly level to gently sloping topography; low borrow potential; surface layer high in organic-matter content.	Some areas too porous to hold water; reservoir bottom should be scarified and compacted.
Zook (Zk)	Not suitable	Not suitable	Not suitable	Not suitable; poor bearing capacity; high shrink-swell potential; highly elastic; difficult to compact to high density.	Level or depressed topography; upper layers high in organic-matter content; high water table; subject to flooding.	Level or depressed topography; subject to flooding.
Zook, overwash (Zo)	Not suitable	Not suitable	Not suitable	Not suitable; poor bearing capacity; high shrink-swell potential; highly elastic; difficult to compact to high density.	Level or depressed topography; upper layers high in organic-matter content; high water table; subject to flooding.	Level or depressed topography; subject to flooding.

[1] Engineers and others should not apply specific values to the estimates given for bearing capacity of soils.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con. — Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings [1]
Fair stability; good compaction and workability in till; moderate or high shrink-swell potential.	Not needed	Moderate intake rate; high available moisture holding capacity; subject to erosion.	Suitable, but cuts in terraces should be held to a minimum; subsoil low in fertility.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight	Slight; good bearing capacity and low compressiblity in till.
Good stability; fair or good compaction; not suitable for core; can be used in shell; moderate or low shrink-swell potential.	Not needed	Moderate intake rate; moderate available moisture holding capacity; limit irrigation to depth of 30 to 45 inches; favorable production potential.	Suitable, but cuts should be held to a minimum to prevent exposure of sandy substratum.	Well suited	Slight; poor filtering material in substratum.	Slight; low compressibility in coarse strata; good bearing capacity; negligible volume change in substratum on wetting.
Fair stability; fair compaction and workability; moderate or high shrink-swell potential.	Not needed	Moderate intake rate; high available moisture holding capacity; favorable potential production.	Length of slopes makes terrace construction difficult; terraces not needed in most areas.	Well suited	Slight	Slight or moderate; high compressibility; fair bearing capacity.
Fair stability; poor compaction and workability; high shrink-swell potential.	High water table; tile may not be effective in all places; proper spacing and depth important; most areas need protection from flooding.	Intake rate varies with amount of vertical cracking; high available moisture holding capacity.	Terraces not needed; diversions on soils upslope help to protect soils from runoff from adjacent uplands.	Not needed, because of topography.	Very severe; slowly permeable; subject to flooding.	Severe; poor bearing capacity; medium or high compressibility; high water table; subject to dangerous shrinkage on drying, and to dangerous expansion on wetting.
Fair stability; poor compaction and workability; high shrink-swell potential.	High water table; tile may not be effective in all places; proper spacing and depth important; most areas need protection from flooding.	Intake rate varies with amount of vertical cracking; high available moisture holding capacity.	Terraces not needed; diversions on soils upslope help to protect soils from runoff from adjacent uplands.	Not needed, because of topography.	Very severe; slowly permeable; subject to flooding.	Severe; poor bearing capacity; medium or high compressibility; high water table; subject to dangerous shrinkage on drying, and to dangerous expansion on wetting.

[2] Soil features variable. Classification not possible.

TABLE 6.—*Engineering test data for soil*

[Tests performed by the Iowa State Highway Commission in accordance with standard

Soil name and location	Parent material	Iowa report No. (AAD9)	Depth	Horizon	Moisture-density data[1] Maximum dry density	Moisture-density data[1] Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Clinton silt loam: SW¼SE¼ sec. 23, T. 79 N., R. 12 W.	Loess.	10441	0 to 6	A1	92	23
		10442	10 to 28	B2	103	20
		10443	54 to 66	C1	104	19
Fayette silt loam: SW¼NE¼ sec. 3, T. 81 N., R. 11 W.	Loess.	10432	0 to 5	Ap	101	18
		10433	9 to 19	B1 and B2	102	21
		10434	49 to 71	C1	95	20
Ladoga silt loam: SE¼ sec. 26, T. 80 N., R. 11 W.	Loess.	10451	0 to 8	A1	94	22
		10452	12 to 32	B2	98	20
		10453	55 to 72	C1	108	16
Lindley loam: SW¼NE¼ sec. 32, T. 78 N., R. 11 W.	Kansan glacial till.	10438	0 to 7	A1	104	17
		10439	11 to 34	B21 and B22	113	15
		10440	46 to 84	C1	121	11
Mahaska silty clay loam: NW¼SE¼ sec. 21, T. 80 N., R. 10 W.	Loess.	10435	0 to 15	Ap and A1	91	25
		10436	25 to 37	B2	96	23
		10437	49 to 73	C1	104	18
Nodaway silt laom: NW¼NE¼ sec. 32, T. 78 N., R. 11 W.	Alluvium.	10447	0 to 63	C1	99	20
Otley silty clay loam: NE¼NE¼ sec. 28, T. 80 N., R. 10 W.	Loess.	10448	0 to 13	A1	91	22
		10449	18 to 43	B21 and B22	99	21
		10450	58 to 74	C1	103	19
Taintor silty clay loam: SW¼SE¼ sec. 21, T. 80 N., R. 10 W.	Loess.	10454	0 to 16	A1	90	27
		10455	25 to 36	B2	99	21
		10456	47 to 65	C1	105	18
Wabash silty clay: SW cor., SE¼ SE¼ sec. 26, T. 78 N., R. 10W.	Alluvium.	10444	0 to 14	A11 and A12	87	28
		10445	24 to 39	B21g	99	19
		10446	57 to 72	B3g–C1	96	24

[1] Based on AASHO Designation: T 99–57, Method A (*1*).
[2] Mechanical analysis according to AASHO Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser

Conservation Engineering[6]

In Iowa County, engineering work for soil conservation consists mainly of building erosion control structures that reduce the loss of soil, and of carrying out practices that increase productivity.

Erosion control structures

Terraces.—A terrace is a channel built across a slope to intercept runoff or seepage and to help control erosion. Only graded terraces are used in Iowa County. These terraces help to control erosion by reducing the length of the slope so that the soils can be used more intensively for row crops without excessive soil loss. There is more freedom in alining terraces on such soils as the Tama and Otley, which are deep and have a favorable subsoil, than on shallow soils or on soils that have a poor subsoil, because deeper cuts and higher fills can be made. Table 5 shows the suitability of the soils in the county for terracing.

Terraces are needed on many soils in Iowa County but generally are not suitable on soils that have a slope of more than 12 percent. Many of the soils in the county that were

[6] BY GEORGE W. FONKEN, agricultural engineer, Soil Conservation Service.

samples taken from nine soil profiles

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [2]												Liquid limit	Plasticity index	Classification	
Percentage passing sieve—								Percentage smaller than—						AASHO	Unified [3]
1-in.	¾-in.	⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.	0.001 mm.				
------	------	------	------	------	100	99	98	92	28	19	15	44	17	A-7-6(12)	ML-CL.
------	------	------	------	------	------	------	100	96	39	32	29	43	21	A-7-6(13)	CL.
------	------	------	------	------	100	99	98	94	36	26	22	39	18	A-6(11)	CL.
------	------	------	------	------	------	100	99	91	30	16	10	32	8	A-4(8)	ML-CL.
------	------	------	------	------	------	------	100	93	40	31	27	47	24	A-7-6(15)	CL.
------	------	------	------	------	------	------	100	92	33	27	21	42	21	A-7-6(13)	CL.
------	------	------	------	100	99	98	97	88	26	17	11	43	13	A-7-5(10)	ML.
------	------	------	------	------	------	100	99	93	36	31	27	43	20	A-7-6(13)	CL.
------	------	------	------	------	100	99	97	92	31	23	17	34	15	A-6(10)	CL.
------	------	------	100	99	90	79	51	39	13	8	5	31	7	A-4(3)	ML-CL.
100	99	99	99	98	89	79	57	49	31	26	23	36	18	A-6(8)	CL.
100	99	98	98	96	86	75	52	45	24	19	15	30	16	A-6(6)	CL.
------	------	------	------	------	------	100	99	93	38	25	18	45	18	A-7-6(12)	ML-CL.
------	------	------	------	------	------	100	99	95	46	37	31	53	26	A-7-6(17)	MH-CH.
------	------	------	------	------	------	100	99	93	33	27	21	43	23	A-7-6(14)	CL.
------	------	------	------	------	------	100	94	85	28	20	16	38	14	A-6(10)	ML-CL.
------	------	------	------	------	------	100	99	93	37	27	20	43	16	A-7-6(11)	CL.
------	------	------	------	------	------	100	99	94	43	34	20	48	23	A-7-6(15)	CL.
------	------	------	------	------	------	------	100	92	32	26	22	42	20	A-7-6(12)	CL.
------	------	------	------	------	------	100	99	91	40	31	25	47	19	A-7-6(13)	ML-CL.
------	------	------	------	------	------	100	99	94	48	40	34	59	35	A-7-6(20)	CH.
------	------	------	------	------	------	------	100	91	32	25	19	41	20	A-7-6(12)	CL.
------	------	------	------	------	------	100	99	95	63	49	39	69	35	A-7-5(20)	MH-CH.
------	------	------	------	------	------	100	99	97	63	51	42	67	41	A-7-6(20)	CH.
------	------	------	------	------	------	------	100	98	75	60	50	83	53	A-7-5(20)	CH.

than 2 millimeters in diameter is excluded from calculations of grain-sized fractions. The mechanical analysis data used in this table are not suitable for use in naming texture classes for soils.

[3] SCS and BPR have agreed to consider that all soils having plasticity indexes within two points from A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are ML-CL and MH-CH.

derived from loess have slopes of less than 12 percent, and are well suited to terracing. Soils that were derived from till, such as the Lindley, Adair, Keswick, Gara, and Shelby, are not well suited to terracing. These soils have an infertile subsoil that becomes exposed in the terrace channels. Their slopes are irregular and are difficult to terrace without exposing a considerable amount of the subsoil. If the Adair and Keswick soils are terraced, interceptor tile drains may be needed.

The Chelsea and Hagener soils are sandy and thus are not suited to terracing. Terrace channels, ridges, and outlets are extremely difficult to maintain on these soils.

Diversions.—A diversion is a channel constructed across the slope to intercept surface water and channel it to a safe outlet. Diversions can be used in Iowa County to protect nearly level soils on first and second bottoms from being flooded by surface runoff from adjacent higher lying soils. The Judson, Ely, Coppock, Wiota, Bremer, and Nevin soils occur on low toe slopes or on alluvial fans. A diversion built up slope from these soils not only reduces flooding by local runoff but also prevents siltation (fig. 17). The Colo, Nodaway, Zook, Amana, Lawson, and Wabash soils occur on bottom lands or along waterways and are also benefited by the use of diversions.

Figure 17.—The siltation of the Judson soil in the foreground could have been prevented by the construction of a diversion at the base of the Fayette soils in the background.

Grassed waterways.—A grassed waterway is a vegetated channel that conducts runoff, at a nonerosive velocity, to a stable outlet. Many of the waterways in the county are gullied and are lined with trees and brush. In these, large quantities of earth will have to be moved before the channels can be properly shaped. Generally, the soils are fertile enough to grow vegetation to help control erosion if the waterways are shaped and velocity of runoff is reduced. In most places tile lines are needed on both sides of the shaped waterway to permit the grass to become established and to reduce wetness so that the waterway can be crossed with farm machinery.

Other structures for erosion control.—Structures for the control of gullies in Iowa County range from reinforced concrete dams for low heads on stable grades to earthfill detention dams with pipe spillways for high heads on unstable grades. Earthfills that are relatively impervious generally can be built by excavating a core trench in the organic surface layer and backfilling with more impervious material. Many such structures have been built on the Colo, Ely, and Nodaway soils.

Earth dams can be readily built in most areas in Iowa County because suitable borrow material commonly is available. Generally, soil material derived from glacial till is best suited for borrow material. Hydraulic sand occurs in areas adjacent to the Iowa River, and pockets or strata of saturated sand and silt, high in organic-matter content, occur in places along drainageways on uplands. Consequently, careful coring is required on all earthfill detention dams.

Each erosion control structure presents difficult problems. Therefore, technical assistance should be obtained before major structures are planned.

Farm ponds.—By making water available to livestock on all parts of a farm, farm ponds help to control erosion because more acreage can be used for rotation grazing. Farm ponds also furnish supplemental water for livestock during extended dry periods when many wells in the county go dry. Most soils in the county provide suitable sites for ponds.

Most farm ponds in the county are constructed in rolling soils derived from glacial till or in soils derived from alluvium. Watertight ponds can be constructed in most places by excavating a core trench through the highly organic topsoil and backfilling with more impervious glacial material. Strata or pockets of sand occur in places in the glacial till and in old alluvium along waterways. Because this coarse-textured material presents special problems, each site needs to be thoroughly investigated.

Farm ponds are of primary importance in soil associations 2 and 6. The soils in these associations generally are well suited to ponds, and nearly every farm has good available sites. Ponds are also needed in soil association 7, but the soils as a whole are more permeable than those in associations 2 and 6. Thus, deep soil borings should be made on each prospective site. In soil association 5, many of the soils are too porous to hold water. The Chelsea, Hagener, and Dickinson soils, for example, generally do not provide suitable sites for ponds. There are some soils in this association that are suitable, but, before a site is selected, deep soil borings should be made. Technical assistance is available through the local Soil Conservation District.

Practices that increase soil productivity

Drainage.—Many soils of Iowa County require artificial drainage for optimum production. Tile drainage is preferred if outlets are available and if the soils are permeable enough for tile to function properly. Open ditches are used in areas where the soils are not suited to tile or in places where outlets for tile would be expensive. Open ditches are confined almost entirely to soils on bottom lands in soil association 3.

Table 5 gives the suitability of the soils in the county for drainage. For specific depth and spacing, contact your local Soil Conservation Service.

The Adair soils have a very slowly permeable subsoil. Therefore, tile placed directly in these soils will not work satisfactorily. It will, however, intercept seepage if the lines are placed immediately upslope at the contact of the loess and glacial till. This practice is common in the county because small seepy areas on hillsides may prevent farmers from cultivating an entire field at one time. Interceptor tile lines are also used in places at the upper boundary of the Ely, Nodaway, and Colo soils.

Tile does not function well in the Sperry, Walford, and Chariton soils, because of their slowly permeable subsoil. Shallow surface ditches can be used to remove surface water from these soils.

The Wabash soils are very slowly permeable and are best drained by drainage ditches. If these soils are used for row crops, each row should slope toward collection ditches. A bedding system or land grading may be needed to obtain such drainage. Open ditches are best on the Colo, Zook, and other soils on bottom lands. Tile can be used if suitable outlets can be obtained. Drainage is slow on the Zook soils, and the proper spacing for tile is difficult.

Irrigation.—The opportunity for irrigated farming is limited in Iowa County because the flow of streams is small, adequate wells generally are not available, and reservoirs commonly are not practical. Reservoirs would be expensive to build and would be difficult to maintain because of high rate of sedimentation. Table 5 shows the suitability of the soils for irrigation if water is available.

Genesis, Classification, and Morphology of the Soils

This section presents the outstanding morphologic characteristics of the soils of Iowa County and relates them to the factors of soil formation. It deals with the environment of the soils, with the classification of soils into great soils groups, and with the morphology of the soils.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent materials; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material (*5*).

Climate and vegetation are active factors of soil genesis. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. It may be much or little, but some time is always required for horizon differentiation. Usually, a long time is required for the development of distinct horizons.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material

Most of the soils in Iowa County developed from glacial till (ice-laid material), loess (windblown material), and alluvium (water-laid material). Local loess and eolian sands are of minor importance along the English and Iowa Rivers. On the whole, soil parent materials are less important to the general character of the profiles in Iowa County than the other factors of soil formation, unless the parent material is nearly pure quartz sand. Sand dominates in the formation of the soil and determines the kind of profile that can be formed.

Glacial till.—The major Pleistocene deposits of pre-Wisconsin age in Iowa County are Nebraskan and Kansan drift (*20*, *21*). The Nebraskan drift is not identifiable on the surface in Iowa County. The Kansan drift is identifiable throughout the county, and on steep slopes it forms an extensive part of the landscape (*12*). Glacial till is the dominant lithologic unit and is composed of coarse fragments in a loam to clay loam matrix. The lower part, which is dark gray and calcareous, contains limestone and dolomite particles and is the unoxidized and unleached zone. Above this zone is yellowish-brown till that is calcareous, and above this is yellowish-brown till that is noncalcareous.

Soils developed on the Kansan till plain during the Yarmouth and Sangamon interglacial ages. This was before the loess was deposited. In nearly level areas, the soils were strongly weathered and had a gray plastic subsoil, called gumbotil (*6*, *7*). This gumbotil is several feet thick and is very slowly permeable. A widespread erosion surface has cut below the Yarmouth-Sangamon paleosol into Kansan till and older deposits. The surface is characterized generally by a stone line or subjacent sediment and is surmounted by pedisediment (*12*, *14*). A paleosol formed in the pedisediment stone line and in places in the subjacent till.

Geologic erosion has removed the loess from many slopes and has exposed strongly weathered paleosols. In some places the paleosols have been beveled or truncated so that only the lower part of the strongly weathered soil remains. In other places erosion has removed all of the paleosol and has exposed till that is only slightly weathered at the surface.

The Adair and Keswick soils formed where the less strongly weathered, reddish paleosols crop out. The strongly weathered gray paleosols crop out only in narrow bands in Iowa County and are included in the Adair soils. The Shelby, Gara, and Lindley soils formed in unweathered or only slightly weathered Kansan till (fig. 18).

Another till of Wisconsin age, currently recognized in Iowa as Iowa drift (*8*), covered the extreme northeastern corner of the county.[7]

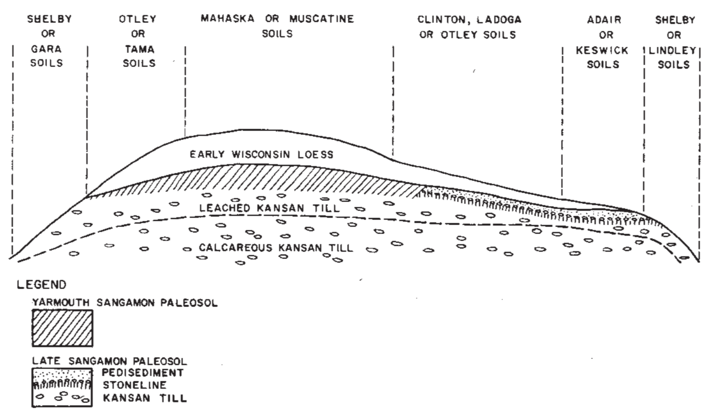

***Figure 18.*—Relationship of underlying parent material to some soils in the county.**

[7] Current studies in the type Iowan of northeastern Iowa indicate that studies prior to 1960 are questionable. Intensive, detailed geomorphic and stratigraphic work shows that the Iowan landscape is a multileveled sequence of erosion surfaces and that many of these levels are cut into Kansan and Nebraskan till (*29*).

The Bassett and Kenyon soils are the major soils in Iowa County that developed from this till. The Dinsdale and Waubeek soils developed in thin loess over this till.

Loess.—Loess of Wisconsin age covers most of Iowa County and is the most extensive parent material in the county (*11*). It consists of accumulated particles of silt and clay that have been deposited by wind. Variations in the soils are related to their distance from the source of loess (*4*). Along the Iowa River, the loess is as much as 30 feet thick in some places. On stable upland divides, it is 18 feet thick, or less. On slopes of more than 9 to 14 percent, the loess is thin or lacking, and the glacial till is exposed.

In Iowa County, soils that developed in loess are in the Tama, Muscatine, Fayette, Downs, Otley, Mahaska, Taintor, Ladoga, Stronghurst, Atterberry, and Walford series. These soils are lower in content of sand than most of the other soils in the county.

The loess-covered uplands that border the Iowa River rise from 100 to 200 feet above the flood plain. The loess in these areas contains a higher percentage of sand than the loess a few miles away.

The loess-derived soils in Iowa County have been the subject of much study and investigation. According to genetic theory, the loess-derived soils in southeastern Iowa, which include the loess soils in Iowa County, can be arranged in a number of sequences. One sequence studied previously is the increasing clay content in the B horizon with decreasing loess thickness (*2*, *3*, *4*). Loess thickness in Iowa decreases systematically but in various directions in different parts of the State. Hunter (*3*), in his traverse, shows that the loess thins exponentially from about 320 inches in Marshall County near the Cary drift border of central Iowa to about 100 inches in southwest Henry County in southeastern Iowa.

The Tama series has been discussed in some detail by Smith and others (*23*). The Clinton and Fayette soils were studied in detail by Muckenhirn and others (*10*). Cain and others (*2*) reported on the sequence relationship of the forested Planosol which included the Traer and Beckwith (preferable name is Rushville). White and others (*28*) studied the Brunizem-Gray Brown Podzolic soils of the biosequence which included the Fayette, Downs, and Tama. Hunter and others (*3*) studied the Tama, Otley, and Grundy. Corliss [8] reported on the Walford, Atterberry, Stronghurst, Rubio, Givin, Ladoga, and Keomah soils. Schafer [9] sampled and studied the Garwin and Taintor soils.

Alluvium.—Alluvium consists of sediments that have been removed and laid down by water. While being moved, these sediments are sorted to some extent, but they are seldom as well sorted as loess and do not contain the wide range of particle sizes found in glacial drift. For example, alluvium may consist of silt and clay, silt and sand, or sand and gravel. In Iowa County, the alluvium is derived from loess and glacial drift and, therefore, consists largely of a mixture of silt and clay or silt and sand. Where sediments have accumulated at the foot of the slope on which they originated, the materials are referred to as colluvium, or local alluvium. Alluvial sediments are the parent materials for the soils on flood plains, on terraces, and along drainageways.

As the river overflows its channel and the water spreads over the flood plain, coarse-textured materials, such as sand, are deposited first. The sand commonly is deposited in low ridges parallel to and near the channel. These ridges are known as natural levees. As the floodwater continues to spread, it moves more slowly, and fine-textured sediment, such as silt, is deposited. After the flood has passed, the finest particles, or the clay, settles from the water that is left standing in the lowest part of the flood plain.

This pattern of sedimentation can be best demonstrated in Iowa County by observing the soils on flood plains along the Iowa River. Near the channel, or within the present meander belt, are recent alluvial soils, or Alluvial land. Alluvial land consists of some sandbars next to the channel and of various amounts of sand, silt, and clay. Where floods do not spill over the natural levees, some finer textured material is deposited. On bottom lands, away from the meander belt, the Amana and Nodaway soils developed. These soils consist mainly of silt and some sand and clay. Beyond these soils, and commonly as much as half a mile from the present channel, the finer textured Colo soils occur. Farthest away from the main channel are the Wabash and Zook soils, which contain a higher percentage of clay than the other alluvial soils and generally are at a lower elevation than the Amana and Nodaway soils.

This sequence of soils repeats itself many times along both the Iowa and English Rivers but varies in places mainly because of the effect of side streams. Over the centuries, the river channel will migrate back and forth across much of the flood plain, sometimes cutting out natural levees laid down earlier, sometimes depositing sand on top of slack-water clays, or vice versa.

Textural differences are accompanied by some differences in chemical and mineralogical composition of the alluvium. The soils for the most part are free of carbonates and are slightly acid, with the exception of the Amana soils, which are medium or strongly acid.

The soils on terraces or second bottoms also consist of alluvium and vary in texture. These alluvial soils, in order of increasingly fine texture, are the Dickinson, Waukegan, Wiota, Nevin, Bremer, and Chariton.

The Ely and Judson soils are the principal soils that formed at the base of upland slopes or from local alluvium. They are widely distributed throughout the county and make up a large percentage of the alluvial soils.

Eolian sand.—Eolian sand is not an extensive parent material in Iowa County. Deposits occur along both the Iowa and English Rivers but are most extensive on the south side of the Iowa River. The Iowa River enters the county at the northwest corner and flows in a southeasterly direction until it reaches Marengo, near the north-central part of the county. There it changes direction and flows in an almost easterly direction. It is on the south side of the river, east of Marengo, that eolian sands are most extensive.

Some smaller areas within elongated ridges orient from a northwesterly to southeasterly direction in what are called pahas (*18*, *19*). However, the pahas are mainly

[8] CORLISS, JOHN F., GENESIS OF LOESS-DERIVED SOILS IN SOUTHEASTERN IOWA. 1958 unpublished Ph.D. thesis. Copy on file at Iowa State University Library, Ames, Iowa.

[9] SCHAFER, GEORGE M., PROFILE PROPERTIES OF A LOESS-DERIVED WIESENBODEN SEQUENCE OF SOUTHEASTERN IOWA. 1954 unpublished Ph.D thesis. Copy on file at Iowa State University Library, Ames, Iowa.

silty in texture rather than sandy. Eolian sand consists largely of quartz, which is resistant to weathering and has not been altered appreciably since being deposited. The Hagener and Chelsea soils developed in eolian sand and can be distinguished from other soils by their high uniform content of fine sand and very fine sand and their low content of clay.

Climate

Available evidence suggests that in Iowa County the soils have been developing under the influence of mid-continental, subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate was conducive to forest vegetation (*12*). The morphology of most soils of Iowa County indicates that the soils developed in a climate similar to the present climate.

The influence of the general climate of the region is modified by local conditions in or near the developing soil. For example, south-facing dry sandy slopes have a microclimate that is warmer and less humid than the average climate of nearby areas. The low-lying, poorly drained bottoms and terraces are wetter and colder than most areas around them. These contrasts account for some of the differences in soils within the same general climatic region.

Plant and animal life

Plant and animal life are important factors in soil formation. Plant life is especially significant. Soil formation really begins with the coming of vegetation. As plants grow and die, their remains are added to the soil. Burrowing animals, earthworms, protozoa, fungi, and bacteria help convert these raw plant remains into organic matter. Many kinds of micro-organisms are needed to transform organic remains into stable humus from which plants can obtain nutrients. The organic matter, or humus, gives the dark color to the surface soil.

Because grasses have many roots and tops that have decayed on or in the soil, soils formed under prairie vegetation have a thick, dark-colored surface layer. Prairie vegetation occurs on the broad undulating or gently rolling uplands.

In contrast, soils formed under timber vegetation have a thinner, lighter colored surface layer because the organic matter, which was derived principally from leaves, was deposited only on the surface of the soil. Forest vegetation has been established on rolling to broken uplands along rivers and large creeks.

In many areas the soils are transitional between Brunizem and Gray-Brown Podzolic soils. Trees invaded the prairie by spreading up the valley slopes and across the divide. In some areas the invasion was complete for a long period of time. In many areas, however, the invasion of trees was either scattered or was for less time than was necessary for the podzolization process to destroy all prairie characteristics. It is in these intergrade areas that such soils as the Ladoga, Downs, and Gara occur.

In some isolated Brunizem areas, some profiles suggest that the soils were forested and later invaded by prairie vegetation. In these areas, the soils have a very brown, thick A1 horizon and only very slight, if any, evidence of an A2 horizon. The A horizon is much like that of the typical Brunizem, but the stronger blocky structure, more prominent clay films, blanched silt or sand grains on ped surfaces in the B horizon are typical of Gray-Brown Podzolic soils in Iowa County. The blanched silt and sand grains are very noticeable when dry. These morphological differences were noticed both in soils on uplands and on terraces, but a complete morphological study was not made at this time.

Relief

Relief is an important cause of difference among soils. Indirectly, it influences soil development through its effect on drainage. In Iowa County, the relief ranges from level to steep. Many nearly level areas are frequently flooded and have a high or periodically high water table. In nearly level areas and depressions that are not subject to flooding, water soaks in. On stronger slopes, much of the rainfall runs off.

In general, the soils in Iowa County that formed under a high or periodically high water table have a dominantly olive-gray subsoil, such as that of the Taintor, Zook, and Wabash soils. Those that developed where the water table was below the subsoil have a yellowish-brown subsoil like that of the Tama, Otley, and Fayette soils. Soils such as the Muscatine, Mahaska, and Nevin formed where natural drainage was intermediate. Of the soils that developed under prairie, those that have a high water table generally have more organic matter in the surface layer than those that have good natural drainage. If there is a slight depression in the topography, silt as well as clay will accummulate in the subsoil, and other soil material will wash in from surrounding areas and accumulate on the surface. These soils will have very poor natural drainage. This kind of soil development is represented by the Chariton and Sperry soils.

Variations that correspond to the above are likely to develop on each of the various parent materials of the county, according to the differences in relief.

Time

The length of time that the soil material has been developing affects the kind of soil that develops. An older or more strongly developed soil shows well-defined genetic horizons. A less well-developed soil shows only weakly developed horizons or none.

Some of the alluvial materials have not been in place long enough for the climate and vegetation to develop well-defined genetic horizons in the profile. For this reason, most soils on the flood plains are weakly developed. In Iowa County, this factor is reflected in the Nodaway and Lawson soils.

In steep areas, soil material is removed before it has had time to develop into a deep soil profile. Even though the soil has been developing for a long time, it is still immature because little of the material stays long enough after it weathers to develop completely as a soil. The Hopper soil is an example of this condition.

Radiocarbon studies of wood fragments found in glacial till and loess have made it possible to determine the approximate ages of soils and glacial deposits in Iowa.

According to studies made by Ruhe and Scholtes, the Adair and Keswick soils are among the oldest soils in the county (*15*, *16*). These soils formed from Kansan till which began to weather in the Late Sangamon interglacial stage. The Shelby, Lindley, and Gara soils formed from Kansan till, which was exposed in the Wisconsin stage and in recent times.

The loess that covers much of Iowa County, and from which the Otley, Tama, Downs, Fayette, Clinton, and related soils developed, is probably 14,000 to 16,000 years old, the maximum age for these soils (*13*).

Man's influence on the soil

Important changes take place in the soil when it is cultivated. Some of these changes have little effect on soil productivity; others have drastic effects.

Changes caused by water erosion generally are the most apparent. On many of the cultivated soils in the county, particularly those on gently rolling to hilly slopes, part or all of the original surface layer has been lost through sheet erosion. In some places shallow to deep gullies have formed. Some gullying on uplands may have been accelerated by the straightening of stream channels. Even in fields that are not eroded, the compaction of the soil by heavy machinery during cultivation reduces the thickness of the surface layer.

Wind erosion has been active in many of the nearly level cultivated fields. Dark-colored soil mixed with snow, in or near plowed fields, is a definite sign that the surface soil is being blown away. Recently formed dunes along fence rows is another indication of soil loss.

In many fields that are cultivated continuously, the well-developed granular structure of the surface layer, so apparent in virgin grassland, has begun to break down. In such fields, the surface soil tends to bake and to become hard when dry. Fine-textured soils that have been plowed continuously when too wet tend to puddle and are less permeable than similar soils in undisturbed areas. In some fields of fine-textured soils, a compact layer, which hardens in drying and is less permeable than the subsoil, has formed below the plow layer. This layer is called a plowsole, or plowpan.

Of course, man has done much to increase productivity of the soils and to reclaim areas not suitable for crops. For example, the establishment of drainage ditches and the construction of diversions at the foot of slopes to prevent the flooding of lowlands have made large areas of bottom lands in the county suitable for cultivation.

Through the use of commercial fertilizers, man has been able to counteract deficiencies in plant nutrients so that the soil can be made more productive than the virgin soil.

In many cultivated fields, the soil has changed slightly in color from nearly black, when moist, to a lighter color, but little data are available to indicate what percentage of organic matter is lost through cultivation. Figures indicate (*23*), however, that the organic-matter content is reduced as much as a third by causes other than erosion. To date, most of the soils of Iowa County have not been seriously affected by the loss of organic matter. Land-use practices have shown that it is not economically feasible to maintain so high a reserve of organic matter as was originally found under native grasses. Nevertheless, it is necessary to keep the organic-matter content at a safe and economical level for crop production.

Soil Morphology

Relatively few morphological features are common to a large number of soils in Iowa County. The principal features result chiefly from climate, plant and animal life, or parent material. The effect of climate is reflected in the depth of the solum, which is fairly uniform in soils on the undulating and rolling uplands. In many profiles, the effect of plant and animal life is denoted by a deep, dark-colored A horizon. The nature of the parent material is apparent in the silty character of the soils, most of which formed from loess.

In Iowa County, soil morphology is indicated by faint to prominent horizons. Examples of soils with prominent horizons are the Chariton, Clinton, Lindley, Adair, and Sperry. Soils with little horizonation (faint horizons) are the Nodaway, Colo, Hopper, and Hagener.

Soil horizons developed as the result of one or more of the following processes: (1) accumulation of organic matter, (2) leaching of calcium carbonate and bases, (3) formation and translocation of silicate clay minerals, (4) reduction and transfer of iron, and (5) accumulation of calcium carbonates. In most soils of the county, two or more of these processes have taken place in the development of horizons.

Most soils in Iowa County have some accumulation of organic matter in the uppermost part that forms an A1 horizon. These soils range from high to very low in organic-matter content. For example, the Fayette, Clinton, Stronghurst, and Chelsea soils have a thin A1 horizon and are low in organic-matter content, whereas the Taintor and Colo soils have a thick A1 horizon and are high in organic-matter content. Some soils that were high in organic-matter content are now quite low because of erosion. The accumulation of organic matter has been a most important process of horizon differentiation.

Leaching of carbonates and bases has occurred in nearly all of the soils in the county. Leaching normally takes place before and during the translocation of silicate clay minerals in soils. The Adair, Clinton, Chariton, Lindley, Givin, and Keomah soils have strongly leached profiles, and their B horizons have the maximum accumulation of silicate clay. Most soils in the county are moderately or strongly leached.

The translocation of silicate clay minerals is another important factor in horizon development of the soils of Iowa County. In the Gray-Brown Polzolic soils, silicate clays move from an upper to a lower layer. The clay is carried in suspension by percolating water until it is deposited as films along former root channels or on the faces of structural aggregates in the B horizon. The B horizon generally has an accumulation of clay in pores and as clay films on ped surfaces. The leaching and translocation of silicate clay is one of the most important processes in horizon differentiation in Iowa County.

The reduction and transfer of iron has occurred in all of the very poorly drained and poorly drained soils. This process, which is called "gleying," involves the saturation of the soil with water for long periods of time in the presence of organic matter. It is characterized by the presence of ferrous iron and of neutral gray colors that commonly change to brown upon exposure to air. Some horizons contain reddish-brown mottles, an indication of the segregation of iron into concretions.

An accumulation of calcium carbonates occurs in relatively few soils in the county. Where it does occur, it is in the form of concretions of calcium carbonate in the upper part of the C horizon. Such an accumulation is evident in the Hopper soils and to a lesser extent in some steeply sloping Lindley, Shelby, and Fayette soils. The

only apparent difference between the upper and lower C horizons in these soils is in the presence of calcium carbonates.

Classification of Soils

Soils with certain fundamental characteristics in common are grouped together for the purpose of comparing soils of a particular county with soils elsewhere (*24, 25*). The soils of Iowa County have been grouped according to two classification systems—the 1938–1949 System, and the current Comprehensive System or 7th Approximation. Table 7 shows the great soil groups that are represented in Iowa County, under both classification systems. Under the 1938–1949 System, some soils have been classified in one group but are intergrading toward another great soil group. Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Following is a description of the great soil groups of the 1938–1949 System that are represented in Iowa County.

Brunizems.—Brunizems (Prairie soils) are a zonal group that developed under tall grasses, in a temperate relatively humid climate (*22*). They have a thick (10 to 20 inches), dark-colored A1 horizon; a thick (15 to 24 inches), dark-brown to dark yellowish-brown B horizon; and a yellowish-brown C horizon, which in places contains grayish mottles. They have moderately strong horizon differentiation, as evidenced by a gradual decrease in content of organic matter from the surface to the subsoil. The principal textures are silty clay loam or silt loam in the A horizon; clay loam or silty clay loam in the B horizon; and light clay loam or silt loam in the C horizon. Some Brunizems are sandy. In these, the B horizon commonly is finer textured than the A or C horizon, and horizonation is weak and indistinct. In many places iron-clay bands occur in the lower part of the B horizon or in the C horizon. These bands are from 1/4 to 1 inch thick and contain 3 or 4 percent more clay than the material on either side. Brunizems typically are moderately acid, with a gradual increase in pH in the lower part of the B horizon and in the C horizon. The Tama and Otley soils are good examples of Brunizems.

The encroachment of deciduous trees on the prairie has been related to changing climatic conditions (*9*). With the advance of trees, the Brunizem soil is converted into a transitional soil, with morphological characteristics intermediate to associated Gray-Brown Podzolic soils. Some soil profiles in the county suggest that the reverse cycle occurred; that is, prairie grasses invaded the forest. However, there is no conclusive evidence that this is a fact.

The uneroded transitional soil generally has a thicker, darker colored A1 horizon; less horizon development of an A2 horizon; and less strongly formed structural peds in the B2 horizon than the associated Gray-Brown Podzolic soils. Laboratory data indicate that, genetically, the intergrading soils are related more closely to Gray-Brown Podzolic soils than to Brunizems (*28*).

Humic Gley soils.—Humic Gley soils developed under poor natural drainage. They have a very dark colored A1 horizon, underlain by a dark-gray B horizon, which may or may not have an accumulation of clay. Humic Gley soils are distinguished from Brunizems in that they have a thicker A1 horizon and a darker colored B horizon. In contrast to Gray-Brown Podzolic soils, the Humic Gley soils have a much thicker, darker colored A1 horizon, lack an A2 horizon, and have a darker colored B horizon. They differ from the Planosols in having a thicker A1 horizon and in lacking an A2 horizon. The Bremer, Colo, Taintor, Wabash, and Zook soils represent the Humic Gley great soil group in Iowa County.

Gray-Brown Podzolic soils.—Gray-Brown Podzolic soils, which belong to the zonal order, are the forested counterpart of the Brunizems. They developed primarily under an oak-hickory type of forest. These soils have a relatively thin A1 horizon, which is from 3 to 7 inches thick; a dark grayish-brown to light brownish-gray, acid A2 horizon, which has thin, platy structure; and a dark yellowish-brown to yellowish-brown B horizon, which is from 15 to 30 inches thick. Gray-Brown Podzolic soils are moderately acid throughout the solum and have an accumulation of silicate clay in the B horizon. The Clinton and Fayette soils are typical examples of this great soil group.

Planosols.—Planosols belong to the intrazonal order. These soils have one or more horizons abruptly separated from and sharply contrasting to an adjacent horizon as a result of cementation, compaction, or high content of clay. They developed under forest, marsh grasses, and sedges or under marsh grasses and sedges that were invaded by forest, under poor or very poor drainage conditions. Planosols have a distinctly developed, bleached and leached A2 horizon, and a strongly developed, genetic clayey B horizon, which is commonly called a claypan. The B horizon is silty clay loam to silty clay and has weak to moderate blocky structure. It restricts the movement of water because of the high content of clay. The Sperry, Walford, Coppock, and Chariton soils are examples of Planosols in Iowa County.

Alluvial soils.—The soils of this great soil group occupy flood plains or first bottoms along streams and are subject to flooding. They are developing from relatively recent deposits of alluvium and lack the distinct horizons that are evident in soils of other great soil groups. Each time they are flooded, they receive fresh deposits of alluvial material. The different soil layers commonly reflect the flood history of the soils. The Nodaway soils are an example of this group.

Technical Descriptions of the Soil Series

This section is provided for those who need more detailed information about the soils in Iowa County. A narrative profile description of one soil type is followed by both a detailed description of a representative soil profile and the range of significant characteristics. These descriptions represent the modal concept of the series in Iowa County. Unless otherwise indicated, the Munsell color notations are for moist soils.

ADAIR SERIES. The Adair series consists of moderately well drained Brunizems (Aquic Argiudolls). These soils developed from exhumed Paleosols that formed from Kansan till during late Sangamon time. They occur in bands, or strips, and generally are downslope from the Otley soils and upslope from the Shelby soils. The slope ranges from 5 to 25 percent. Figure 3, page 3, shows

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TABLE 7.—*Classification of the soil series according to the 1938–1949 System and the Comprehensive System, 7th Approximation*

Soil series	1938–1949 System	Comprehensive System, 7th Approximation	
	Great soil group	Family	Subgroup
Adair	Brunizem	Fine, montmorillonitic, mesic	Aquic Argiudoll.
Amana	Brunizem intergrading to Gray-Brown Podzolic.	Fine silty, mixed, mesic	Aquic Hapludoll.
Atterberry	Gray-Brown Podzolic intergrading to Brunizem.	Fine silty, mixed, mesic	Aquollic Normudalf.
Bassett	Gray-Brown Podzolic intergrading to Brunizem.	Fine loamy, mixed, mesic	Mollic Normudalf.
Bertrand	Gray-Brown Podzolic	Fine silty, mixed, mesic	Typic Normudalf.
Bremer	Humic Gley	Fine, montmorillonitic, mesic	Typic Haplaquoll.
Chariton	Planosol	Fine, montmorillonitic, mesic	Typic Argialboll.
Chelsea	Gray-Brown Podzolic intergrading to Regosol	Sandy, siliceous, mesic	Psammentic Normudalf.
Clinton	Gray-Brown Podzolic	Fine, montmorillonitic, mesic	Typic Normudalf.
Colo	Humic Gley intergrading to Alluvial	Fine silty, mixed, mesic	Cumulic Haplaquoll.
Coppock	Planosol	Fine silty, mixed, mesic	Aquollic Argialboll.
Dickinson	Brunizem	Coarse loamy, siliceous, mesic	Typic Hapludoll.
Dinsdale	Brunizem	Fine silty, mixed, mesic	Typic Argiudoll.
Downs	Gray-Brown Podzolic intergrading to Brunizem.	Fine silty, mixed, mesic	Mollic Normudalf.
Ely	Brunizem	Fine silty, mixed, mesic	Aquic Cumulic Hapludoll.
Fayette	Gray-Brown Podzolic	Fine silty, mixed, mesic	Typic Normudalf.
Gara	Gray-Brown Podzolic intergrading to Brunizem.	Fine, montmorillonitic, mesic	Mollic Normudalf.
Givin	Gray-Brown Podzolic intergrading to Brunizem	Fine, montmorillonitic, mesic	Aquollic Normudalf.
Hagener	Brunizem	Sandy, siliceous, mesic	Entic Hapludoll.
Hopper	Gray-Brown Podzolic intergrading to Regosol	Fine silty, mixed, mesic	Dystric Eutrochrept.
Jackson	Gray-Brown Podzolic	Fine silty, mixed, mesic	Aquic Normudalf.
Judson	Brunizem	Fine silty, mixed, mesic	Cumulic Hapludoll.
Kenyon	Brunizem	Fine loamy, mixed, mesic	Typic Hapludoll.
Keomah	Gray-Brown Podzolic	Fine, montmorillonitic, mesic	Aquic Normudalf.
Keswick	Gray-Brown Podzolic	Fine, montmorillonitic, mesic	Typic Normudalf.
Koszta	Gray-Brown Podzolic intergrading to Brunizem.	Fine silty, mixed, mesic	Aquollic Normudalf.
Ladoga	Gray-Brown Podzolic intergrading to Brunizem.	Fine, montmorillonitic, mesic	Mollic Normudalf.
Lamont	Gray-Brown Podzolic	Coarse loamy, siliceous, mesic	Typic Normudalf.
Lawler	Brunizem	Fine loamy, over sandy, mixed, mesic	Aquic Hapludoll.
Lawson	Brunizem intergrading to Alluvial	Fine silty, mixed, mesic	Aquic Cumulic Hapludoll.
Lindley	Gray-Brown Podzolic	Fine, montmorillonitic, mesic	Typic Normudalf.
Mahaska	Brunizem	Fine, montmorillonitic, mesic	Aquic Argiudoll.
Muscatine	Brunizem	Fine silty, mixed, mesic	Aquic Argiudoll.
Nevin	Brunizem	Fine silty, mixed, mesic	Aquic Hapludoll.
Nodaway	Alluvial	Fine silty, mixed, mesic	Typic Udifluvent.
Otley	Brunizem	Fine, montmorillonitic, mesic	Typic Argiudoll.
Shelby	Brunizem	Fine, montmorillonitic, mesic	Typic Argiudoll.
Sperry	Planosol	Fine, montmorillonitic, mesic	Typic Argialboll.
Stronghurst	Gray-Brown Podzolic	Fine silty, mixed, mesic	Aquic Normudalf.
Taintor	Humic Gley	Fine, montmorillonitic, mesic	Typic Argiaquoll.
Tama	Brunizem	Fine silty, mixed, mesic	Typic Argiudoll.
Tell	Gray-Brown Podzolic	Fine silty, mixed ,mesic	Typic Normudalf.
Udolpho	Gray-Brown Podzolic intergrading to Brunizem.	Fine loamy, mixed, mesic	Aquollic Normudalf.
Wabash	Humic Gley	Fine, montmorillonitic, mesic	Cumulic Haplaquoll.
Walford	Planosol	Fine silty, mixed, mesic	Mollic Albaqualf.
Watkins	Gray-Brown Podzolic intergrading to Brunizem.	Fine silty, mixed, mesic	Mollic Normudalf.
Waubeek	Gray-Brown Podzolic intergrading to Brunizem.	Fine silty, mixed, mesic	Mollic Normudalf.
Waukegan	Brunizem	Fine loamy, over sandy, mixed, mesic	Typic Hapludoll.
Wiota	Brunizem	Fine silty, mixed, mesic	Typic Hapludoll.
Zook	Humic Gley	Fine, montmorillonitic, mesic	Cumulic Haplaquoll.

their relationship to associated soils. The native vegetation was prairie grasses.

The Adair soils have a very dark gray to very dark grayish-brown, friable light clay loam or gritty silt loam A1 horizon and a reddish-brown to strong-brown, mottled very firm clay to heavy clay loam B horizon that is very slowly permeable. The reddish mottles decrease in intensity with depth. The reaction is very strongly acid to medium acid. A concentration of small stones and coarse gravel is common in the upper part of the B horizon.

These soils have a finer textured, less permeable, more red B horizon than the Shelby soils. They differ from the

Keswick soils in that they have a darker colored A1 horizon and lack an A2 horizon.

In Iowa County, a thin-solum phase is recognized. This phase has a reddish mottled clay layer, less than 12 inches thick, in the B horizon. Adair clay loam, thin solum, is less permeable than the Shelby soils, which lack the reddish mottled clay layer.

Profile of Adair clay loam, 145 feet west and 330 feet south of center of the SE¼ sec. 7, T. 79 N., R. 10 W. on an 11 percent northwest-facing convex slope, in a meadow, 1¾ miles west and ¼ mile north of Williamsburg, Iowa.

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) clay loam to loam; grayish brown (10YR 5/2) when dry; about 10 percent is dark brown to brown (7.5YR 4/4); friable; small clods break to weak, fine, granular structure; neutral; abrupt, smooth boundary.

B1—8 to 11 inches, dark-brown to brown (7.5YR 4/4) medium clay loam; about 20 percent is very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2); kneads to dark brown to brown (7.5YR 4/2); friable to firm; moderate, fine, subangular blocky structure; common, fine, distinct, dark reddish-brown (5YR 3/4) mottles; slightly acid; clear, smooth boundary.

IIPB12—11 to 17 inches, heavy clay loam; dark reddish brown (5YR 3/4) on exterior of peds, and dark brown to brown (7.5YR 4/4) on interior of peds; kneads to dark brown to brown (7.5YR 4/4); friable to firm; moderate, fine, subangular blocky structure; few very dark gray (10YR 3/1) worm casts; few, thin, patchy clay films; strongly acid; clear, smooth boundary.

IIPB21—17 to 23 inches, very firm gritty clay; dark reddish gray (5YR 4/2) on exterior of peds; mottled red (2.5YR 4/6) and dark reddish gray (5YR 4/2) on interior of peds; kneads to red (2.5YR 4/6); moderate, medium, subangular blocky structure that breaks to strong, fine, subangular blocky and angular blocky structure; common red (2.5YR 4/6) mottles on ped exteriors; common, fine, distinct, dark-red (10R 3/6) mottles; thick continuous clay films; strongly acid; gradual, smooth boundary.

IIPB22—23 to 31 inches, gritty clay; brown (7.5YR 5/2) on exterior of peds, and dark brown to brown (7.5YR 4/4) on interior of peds; kneads to strong brown (7.5YR 5/6); firm; many, fine, prominent, yellowish-red (5YR 4/6) mottles; strong, medium and fine, subangular and angular blocky structure; thick discontinuous clay films; strongly acid; gradual, smooth boundary.

IIPB23—31 to 40 inches, heavy clay loam; brown (7.5YR 5/4) on exterior of peds and strong brown (7.5YR 5/6) on interior of peds; kneads to strong brown (7.5YR 5/6); firm; few, fine, distinct, yellowish-red (5YR 4/6) mottles; moderate, medium, subangular blocky structure; few discontinuous grayish-brown (10YR 5/2) streaks or old channels; few, thin, patchy clay films; few concretions of black oxide; strongly acid; gradual, smooth boundary.

IIPB31—40 to 54 inches, mottled strong-brown (7.5YR 5/6), grayish-brown (2.5Y 5/2), gray (5Y 5/1), and yellowish-brown (10YR 5/6) medium to heavy clay loam; kneads to yellowish brown (10YR 5/4); firm; weak, coarse, subangular blocky structure; few patchy brown (7.5YR 5/2) clay films; many fine concretions of black oxide; many stains on peds, and these increase with depth; medium acid; gradual, smooth boundary.

IIPB32—54 to 65 inches, yellowish-brown (10YR 5/6) light clay loam; friable to firm; many, coarse, distinct grayish-brown (2.5Y 5/2) and gray (5Y 5/1) mottles; kneads to yellowish brown (10YR 5/4); massive with vertical cleavage; few patchy clay films on vertical faces; many concretions of black oxide and many stains on ped faces; slightly acid.

The A1 horizon typically is very dark gray (10YR 3/1) but in eroded areas ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The A horizon ranges from clay loam to silt loam. In places, near loess-derived soils that occur upslope, it is silt loam. The B horizon ranges from clay to heavy clay loam and contains fine gravel and a few pebble-sized igneous rocks. Textural analyses indicate that the Adair soils have a maximum clay content in the B horizon of about 40 to 55 percent. Thickness of this clay layer ranges from 12 to 36 inches for the Adair clay loam and from 6 to 12 inches for the Adair clay loam, thin solum. A zone of mottles or colors of redder hue than 7.5YR generally corresponds to the thickness of the clay layer. The concentration of small pebbles in the upper part of the B horizon may be lacking in some places. The yellowish-brown clay loam glacial till commonly is leached to a depth of 40 inches or more.

Amana Series. The Amana series consists of moderately well drained to somewhat poorly drained soils that formed from medium-textured to moderately fine textured alluvium. These soils are classified as Brunizems that intergrade toward Gray-Brown Podzolic and Alluvial soils (Aquic Hapludolls). They occur mainly on nearly level areas along the major streams and near or within the immediate flood plain. The native vegetation consisted of grasses and some scattered trees.

The Amana soils have a black to very dark gray, friable silt loam to light silty clay loam A horizon, and a dark grayish-brown, mottled, friable light silty clay loam B horizon that has weak horizonation. Stratified layers of silt loam, loam, and sandy loam are common below a depth of 4 feet. The reaction is medium acid or strongly acid below the A horizon.

These soils differ from the Lawson soils in having a thinner A horizon, distinct gray coats in the B horizon, and a more acid solum. They differ from the Koszta soils in that they have a thicker A1 horizon, lack an A2 horizon, and have less clay in the B horizon. They lack the distinct, thick A2 horizon characteristic of the Coppock soils. The Amana soils developed from alluvium, and in places have thin strata of coarse-textured material in the lower part of the B horizon, and they have a lower clay maximum than the Atterberry soils.

Profile of Amana silt loam, 225 feet south of middle of Millrace levee and 400 feet east of center of Highway No. 220 in the NE¼SW¼ sec. 25, T. 81 N., R. 10 W., in a nearly level bluegrass pasture.

A11—0 to 8 inches, black (10YR 2/1) to very dark gray (10YR 3/1) heavy silt loam; kneads to very dark brown (10YR 2/2); friable; moderate, fine, granular structure and moderate, fine, subangular blocky structure; abundant fine roots; neutral; gradual, smooth boundary.

A3—8 to 15 inches, black (10YR 2/1) to very dark gray (10YR 3/1) heavy silt loam; kneads to slightly higher chroma; friable; moderate, very fine and fine, subangular blocky structure; abundant fine roots; medium acid; gradual, smooth boundary.

B1—15 to 25 inches, very dark grayish-brown (10YR 3/2) light silty clay loam; 10 percent is dark grayish brown (10YR 4/2); kneads to very dark grayish brown (10YR 3/2); friable; moderate, medium and fine, subangular blocky structure; few, fine, faint, olive-brown (2.5Y 4/4) mottles; few fine concretions of black oxide; gray (10YR 6/1, dry) silt grains on ped surfaces; medium acid; gradual, smooth boundary.

B21—25 to 35 inches, dark-gray (10YR 4/1) to dark grayish-brown (10YR 4/2) light silty clay loam; kneads to dark grayish brown (10YR 4/2); friable; moderate, medium and fine, subangular blocky structure; few,

fine, faint, yellowish-brown (10YR 5/4) and olive-brown (2.5Y 4/4) mottles, and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; thin, patchy clay films; gray (10YR 6/1, dry) silt grains on ped surfaces; many fine tubular pores; medium acid; gradual, smooth boundary.

B22—35 to 48 inches, light silty clay loam; grayish brown (2.5Y 5/2) on exterior of peds, and dark grayish brown (2.5Y 4/2) on interior of peds; kneads to grayish brown (2.5Y 5/2) to dark grayish brown (2.5Y 4/2); friable; moderate, medium, subangular blocky structure; common, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/4) mottles; few fine concretions of black oxide; gray (10YR 6/1, dry) silt grains on ped surfaces; common fine tubular pores; medium acid; gradual, smooth boundary.

B3—48 to 62 inches, gray (5Y 5/1) heavy silt loam; kneads to grayish brown (10YR 5/2 to 2.5Y 5/2); friable; massive with some vertical cleavage; many, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; common concretions of black oxide; medium acid; clear, smooth boundary.

IIC—62 to 70 inches, gray (5Y 5/1) loam; kneads to dark grayish brown (10YR 4/2); friable; massive; many; fine, distinct, dark yellowish-brown (10YR 3/4 and 4/4) mottles; few fine concretions of black oxide; medium acid.

The A horizon ranges from gritty silt loam to light silty clay loam. It is black (10YR 2/1) to very dark gray (10YR 3/1) and is from 12 to 20 inches thick. Light-gray (10YR 6/1) silt grains are prominent on peds in the lower part of the A and the B horizon when the soil is dry but are indistinct when the soil is moist. The B horizon ranges from silt loam to light silty clay loam. The matrix colors of the B horizon have values of 4 and 5, chromas of 1 and 2, and hues of 10YR to 5Y. Few to common fine mottles generally occur in the upper part of the B horizon and, in places, increase in size and number with depth. The depth to sandy material ranges from 40 inches to more than 5 feet.

Atterberry Series. The Atterberry series consists of somewhat poorly drained soils that developed from loess. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Aquollic Normudalfs). They occur in nearly level areas on tabular divides in the Fayette-Downs soil association and also on a few of the loess-covered benches along the Iowa River and Little Bear and Big Bear Creeks. The slope ranges from 1 to 3 percent. The native vegetation consisted of prairie grasses and trees.

The Atterberry soils have a very dark gray, friable silt loam A1 horizon; a dark-gray to grayish-brown, friable silt loam A2 horizon; and a grayish-brown, friable to firm, mottled silty clay loam B2 horizon. The abundant contrasting mottles in the B2 horizon increase in number with depth. An olive-gray, friable silt loam C horizon is at a depth of about 50 inches. The B horizon generally is medium acid.

These soils occupy positions similar to those occupied by the Givin soils, but they differ from the Givin soils in that they contain less clay, have less well formed structural peds in the B horizon, and generally are less acid. They differ from the Muscatine soils by having a lighter colored thinner A1 horizon and by having an A2 horizon. They generally are more friable and have a lower content of clay in the B3 and C1 horizons than the Koszta soils but commonly have a firmer B2 horizon.

The Atterberry soils are the somewhat poorly drained members of the toposequence that includes the well-drained Downs soils and the poorly drained Walford soils. They are the prairie-forest formed members of the biosequence that includes the prairie-formed Muscatine soils and the forest-formed Stronghurst soils.

Profile of Atterberry silt loam, 80 feet north and 530 feet east of the SW. corner of sec. 5, T. 80 N., R. 12 W., in a meadow, on a nearly level tabular divide.

Ap—0 to 7 inches, black (10YR 2/1) to very dark gray (10YR 3/1) silt loam; kneads to very dark gray (10YR 3/1); friable; clods break to weak, medium, granular structure; few, fine, distinct, gray (10YR 6/1) mottles; neutral; clear, smooth boundary.

A2—7 to 13 inches, 40 percent gray (10YR 6/1) and 60 percent dark-gray (10YR 4/1) silt loam; friable; weak, thin, platy structure breaks to moderate, very fine, subangular blocky structure; few, fine, faint soft concretions of dark-brown to brown (10YR 4/3) oxide; common fine tubular pores; neutral; clear, smooth boundary.

B1—13 to 17 inches, mixed dark grayish-brown (10YR 4/2) and dark-brown to brown (10YR 4/3) light silty clay loam; kneads to dark grayish brown (2.5Y 4/2); friable; weak, medium to fine, subangular blocky structure; gray (10YR 6/1, dry) silt coats on peds; medium acid; clear, smooth boundary.

B21—17 to 28 inches, grayish-brown (2.5Y 5/2) medium silty clay loam; kneads to grayish brown (10YR 5/2 to 2.5Y 5/2); friable to firm; weak, fine, prismatic structure breaks to moderate, medium, subangular blocky structure; few, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; few fine tubular pores; gray (10YR 6/1, dry) silt coats on some peds and thin discontinuous clay films; medium acid; gradual, smooth boundary.

B22—28 to 39 inches, grayish-brown (2.5Y 5/2) silty clay loam; kneads to grayish brown (10YR 5/2 to 2.5Y 5/2); friable to firm; moderate, medium and coarse, subangular blocky structure; common, fine, prominent, yellowish-brown (10YR 5/6), strong-brown (7.5YR 5/6), and gray (5Y 6/1) mottles; few fine tubular pores; gray (10YR 6/1, dry) silt coats and thin continuous clay films; medium acid; gradual, smooth boundary.

B3—39 to 50 inches, olive-gray (5Y 5/2) light silty clay loam; kneads to brown (10YR 5/3); friable to firm; weak, coarse, subangular blocky structure; common, fine, prominent, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; few fine tubular pores; few concretions of iron and manganese; medium acid; gradual, smooth boundary.

Cg—50 to 60 inches, olive-gray (5Y 5/2) silt loam; kneads to grayish brown (2.5Y 5/2) to light olive brown (2.5Y 5/3); friable; massive; many, fine, prominent, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; many concretions of iron-manganese; slightly acid.

The Atterberry soils have characteristics that range between those of the Muscatine soils and those of the Stronghurst soils. They normally have a 4- to 8-inch, black (10YR 2/1) to very dark gray (10YR 3/1) A1 horizon and a 3- to 6-inch A2 horizon. As they grade toward the Muscatine soils, they generally have a less distinct A2 horizon and some darker colored coatings, with a value of 3 in the upper part of the B horizon. As they grade toward the Stronghurst soils, they have a thinner A1 horizon and a dark grayish-brown (10YR 4/2) and grayish-brown (10YR 5/2), distinct A2 horizon. The B horizons range from light silty clay loam to medium silty clay loam. There are few or common mottles in the B2 horizon, but generally there are no mottles in the B1 horizon if the matrix color has a chroma of 2. Mottling

commonly increases with depth. In most places, a silt loam C horizon occurs at a depth of 40 to 54 inches. The reaction is slightly acid or medium acid.

BASSETT SERIES. The Bassett series consists of moderately well drained soils that developed from 10 to 20 inches of loamy material over loam glacial till. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Mollic Normudalfs). They occur mainly in the northeastern part of Iowa County. A small area occurs near Homestead. The slope ranges from 5 to 25 percent. The native vegetation consisted of prairie grasses and a forest of oak and hickory.

These soils have a somewhat thin, very dark gray, friable loam A1 horizon and either a thin, brown, friable A2 horizon or an abrupt boundary to a brown, friable or firm light clay loam B horizon, in which there is a distinct stone line. The C horizon is dark yellowish-brown to yellowish-brown loam. In places some mottling occurs in the lower horizons. In undisturbed areas, there is a weakly defined, grayish-brown A2 horizon. The reaction is strongly acid in the most acid part of the solum.

The Bassett soils differ from the Kenyon soils in having a lighter colored, thinner A1 horizon; an A2 horizon; and distinct silt coats in the B horizon. They differ from the Gara soils in that they have slightly less clay in the B and C horizons. At a depth of 18 to 24 inches, the Bassett soils have two-storied materials with a distinct stone line, which is lacking in the Gara soils. The Bassett soils form a biosequence with the Kenyon soils.

Profile of Bassett loam, 695 feet south and 370 feet east of the NW. corner of the SW¼ sec. 11, T. 81 N., R. 9 W., on a 7 percent convex slope, in an alfalfa field.

Ap—0 to 6 inches, 90 percent very dark gray (10YR 3/1) and 10 percent dark-brown (10YR 4/3) loam to gritty silt loam; kneads to very dark grayish brown (10YR 3/2); friable; abundant fine roots; cloddy; neutral; abrupt, smooth boundary.

A2&B1—6 to 14 inches, dark grayish-brown (10YR 4/2) and dark-brown (10YR 4/3) loam to light clay loam; kneads to dark brown (10YR 4/3); friable; few very dark gray (10YR 3/1) worm casts; abundant roots; weak, fine, subangular blocky structure with some horizontal cleavage; concentration of pebbles, ¼ inch to 2 inches in diameter, at depth of 14 inches; slightly acid; clear, smooth boundary.

IIB21—14 to 22 inches, brown (10YR 5/3) light clay loam; kneads to light yellowish brown (10YR 6/4); friable to firm; weak, medium, prismatic structure breaks to moderate, medium and fine, subangular blocky structure; gray (10YR 6/1) silt grains on peds when dry; few, fine, distinct, gray (10YR 5/1) mottles, and common, fine, distinct, strong-brown (7.5YR 5/8) mottles; thin continuous clay films; strongly acid; gradual, smooth boundary.

IIB22—22 to 30 inches, mottled yellowish-brown (10YR 5/4) and gray (10YR 5/1) light clay loam; kneads to yellowish brown (10YR 5/6); friable to firm; weak, medium, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/8) mottles; thin continuous clay films; common concretions of black oxide; strongly acid; gradual, smooth boundary.

IIB31—30 to 38 inches, light clay loam; gray (5Y 5/1) ped coatings; kneads to light brownish gray (2.5Y 6/2); friable to firm; weak, medium and coarse, subangular blocky structure; gray (10YR 6/1) silt grains on peds when dry; many, fine, prominent, yellowish-brown (10YR 5/6) mottles; thin continuous clay films; few concretions of black oxide; medium acid; gradual, smooth boundary.

IIB32—38 to 47 inches, light clay loam to loam; gray (5Y 5/1) ped coatings; kneads to pale brown (10YR 6/3); friable to firm; few concretions of black oxide; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; medium acid; gradual boundary.

IIC—47 to 60 inches, yellowish-brown (10YR 5/6) loam; friable to firm; few, fine, faint, strong-brown (7.5YR 5/6) mottles; few concretions of black oxide; massive; neutral.

The uppermost 10 to 20 inches of the solum typically is loam or silt loam and is lower in content of sand than the underlying till. The Ap horizon is very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). An A2 horizon is dark grayish brown (10YR 4/2) to dark brown (10YR 4/3) and from 2 to 4 inches thick in uneroded areas. Where the A2 is lacking, there typically is an abrupt boundary with colors that have a value of 4. The B horizon ranges from loam to clay loam. It has hues of 10YR, values of 4 or higher, and chromas of 3 or higher. Some fine mottling is evident in the B horizon and generally increases with depth. Silt and sand coats of 5 or 6 value and 1 or 2 chroma are distinct in this horizon. In places irregularly shaped pockets of dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) coarse sandy loam occur in the lower part of the B horizon and in the C horizon. The C horizon generally is loam. The reaction is strongly acid or very strongly acid in the most acid part of the solum.

BERTRAND SERIES. The Bertrand series consists of well-drained soils that formed from medium-textured alluvium, low in content of sand. These soils are classified as Gray-Brown Podzolic soils (Typic Normudalfs). They occur on stream benches that have a gradient of 0 to 9 percent. The native vegetation was hardwood forests.

The Bertrand soils have a dark-gray to dark grayish-brown, friable silt loam A1 horizon; a grayish-brown, platy A2 horizon; and a yellowish-brown light silty clay loam B horizon. They are free of gray mottles to a depth of 30 inches or more. They are moderately permeable, have high water-holding capacity, and generally are medium acid or strongly acid throughout the solum.

These soils have a thinner A1 horizon and a more distinct A2 horizon than the Watkins soils. They differ from the Koszta soils in that their A1 horizon is lighter colored and thinner and in that the upper part of the B horizon is not mottled and has a chroma of 3. They have colors of higher chroma in the B horizon than the Jackson soils and are not mottled above 30 inches.

The Bertrand soils are the well-drained members of the toposequence that includes the moderately well drained or somewhat poorly drained Jackson soils.

Profile of Bertrand silt loam, 600 feet south and 1,490 feet west of the SE. corner of the NE¼ sec. 13, T. 81 N., R. 11 W., 240 feet west and 65 feet south of road junction, on a south-facing 3 percent convex slope, in a cultivated field.

Ap—0 to 7 inches, dark-gray (10YR 4/1) to dark grayish-brown (10YR 4/2) silt loam; kneads to dark grayish brown (10YR 4/2); friable; clods break to weak, fine, granular structure; abundant fine roots; neutral; abrupt, smooth boundary.

A2—7 to 10 inches, dark grayish-brown (10YR 4/2) to dark-brown (10YR 4/3) silt loam; kneads to dark brown (10YR 4/3); friable; weak, medium, platy structure; few, fine, faint, yellowish-brown (10YR 5/4) peds;

few very dark gray (10YR 3/1) worm casts; few fine tubular pores; slightly acid; clear, smooth boundary.

B1—10 to 16 inches, dark-brown (10YR 4/3) heavy silt loam; kneads to yellowish brown (10YR 5/4); friable; weak, fine, subangular blocky structure; few very coarse sand grains, 1 to 2 millimeters in size; medium acid; gradual, smooth boundary.

B2—16 to 33 inches, yellowish-brown (10YR 5/4) light silty clay loam; friable; moderate, medium and fine, subangular blocky structure; few very coarse sand grains, 1 to 2 millimeters in size; gray (10YR 6/1, dry) silt grains on peds; few, thin, patchy, clay films; few concretions of black oxide; strongly acid; gradual, smooth boundary.

B3—33 to 42 inches, yellowish-brown (10YR 5/4) heavy silt loam; friable; weak, coarse, subangular blocky structure; gray (10YR 6/1, dry) silt grains on peds; few concretions of black oxide; few black (5Y 2/2) oxide stains on ped surfaces; medium acid; abrupt, smooth boundary.

IIC—42 to 55 inches, mixed yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4) silt loam; kneads to light yellowish brown (10YR 6/4); friable; massive; few, fine, distinct, light-gray (10YR 7/1) mottles; common fine concretions of dark reddish-brown (5YR 3/4) and yellowish-red (5YR 4/8) oxide; few concretions of black oxide; layer of yellowish-brown (10YR 5/6) coarse sand and fine gravel, up to 5 millimeters in size, occurs at a depth of 42 to 44 inches; strongly acid.

The A1 or Ap horizon ranges in color from very dark gray (10YR 3/1) to dark gray (10YR 4/1) in uneroded areas. The A1 horizon is 2 to 4 inches thick. The A2 horizon ranges from 4 to 5 in color value, and from 2 to 3 in chroma. It is from 4 to 8 inches thick. The B horizon is dark brown (10YR 4/3) to yellowish brown (10YR 5/4) and is free of mottling to a depth of about 30 inches. Thin patchy clay films are evident in the B horizon but may be masked by gray silt coatings. The depth to stratified material ranges from 42 to 60 inches or more.

Bremer Series. The Bremer series consists of poorly drained soils that formed from alluvium. These soils are classified as Humic Gley (Wiesenboden) soils (Typic Haplaquolls). They occupy nearly level or slightly depressed areas on benches along the Iowa and English Rivers and along some of the smaller creeks in other parts of the county. The native vegetation consisted of prairie grasses and some scattered water-tolerant trees.

The Bremer soils have a black silty clay loam A horizon and a dark-gray heavy silty clay loam to light silty clay B horizon that is mottled with yellowish brown and strong brown. These soils are slowly permeable. In some areas along the Iowa River, they have a sandy loam substratum below a depth of 45 inches.

The Bremer soils differ from the Colo soils in that they have a thinner A horizon, have more clay films and generally more clay in the B horizon, and are mottled higher in the profile. They are firmer in the B3 horizon and upper part of the C horizon than the Taintor soils, and in places they are stratified below a depth of 45 inches. They have grayer hues in the B horizon than the Nevin soils and have a chroma of 1. The Bremer soils have a color value of 3 or less to a shallower depth than the Zook soils and have clay films in the B horizon.

Profile of Bremer silty clay loam, 200 feet north and 730 feet east of the SW. corner of the NW¼NE¼ sec. 32, T. 79 N., R. 12 W., in a nearly level cultivated area.

A1—0 to 13 inches, black (10YR 2/1) light silty clay loam; friable to firm; clods break to weak, fine, granular structure; neutral; gradual boundary.

A3—13 to 21 inches, black (N 2/0 to 10YR 2/1) medium silty clay loam; firm; moderate, very fine, subangular blocky structure; some ped coatings; slightly acid; gradual, smooth boundary.

B21g—21 to 28 inches, dark-gray (5Y 4/1) heavy silty clay loam to light silty clay; firm; moderate, fine, subangular blocky structure; few, fine, prominent, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; thin continuous clay films; slightly acid; gradual, smooth boundary.

B22g—28 to 35 inches, dark-gray (5Y 4/1) medium silty clay loam; firm; moderate, medium, subangular blocky structure; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; thin continuous clay films; slightly acid; gradual, smooth boundary.

B3g—35 to 45 inches, gray (5Y 5/1) medium silty clay loam; firm; massive with some vertical cleavage; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; slightly acid.

The A horizon ranges from 16 to 24 inches in thickness and from light to heavy silty clay loam in texture. The A horizon is black, but the hue ranges from neutral to 10YR. The B horizon is 20 to 30 inches thick. It has a hue of 2.5Y or 5Y, a chroma of 1, and a value of 3 or 4, but the value increases to 5 with depth. Few or common mottles occur in the upper part of the B horizon, but the mottles increase in size and abundance in the lower part. Clay films are evident, but range from few, thin, and discontinuous in some parts of the B horizon to continuous in other parts. The B horizon ranges from heavy silty clay loam to light silty clay.

Chariton Series. The Chariton series consists of very poorly drained Planosols (Typic Argialbolls) that developed from alluvial material and have strong horizonation. These soils occupy slightly depressed areas on benches and bottom lands along the Iowa and English Rivers. Figure 4, page 4, shows their relationship to associated alluvial soils. The native vegetation consisted of water-tolerant prairie grasses.

The Chariton soils have a black to very dark gray silt loam A1 horizon; a platy, gray, prominent A2 horizon; and a black to very dark gray, firm heavy silty clay loam to light silty clay B horizon in which there are thick clay films. Yellowish-brown mottles occur in the lower horizons. The reaction ordinarily is slightly acid or medium acid throughout the solum.

These soils are more strongly developed than the Coppock soils and they have a thinner A2 horizon and a darker colored, finer textured B horizon. They differ from the Bremer soils in that they have a prominent A2 horizon, generally have stronger structure, and are less prominently mottled in the B horizon. The Chariton soils have more clay in the B3 and C horizons than the Sperry soils, which formed from loess, and the depth to the clay maximum typically is greater and varies more in the Chariton than in the Sperry soils.

Profile of Chariton silt loam, 400 feet north and 700 feet east of NW. corner of the SW¼ sec. 4, T. 78 N., R. 12 W., in a slightly depressed cultivated area.

Ap—0 to 6 inches, very dark brown (10YR 2/2) to very dark grayish-brown (10YR 3/2) silt loam; friable; weak, fine, granular structure; slightly acid; abrupt, smooth boundary; this horizon is considered to be overwash.

A11—6 to 14 inches, black (10YR 2/1) to very dark gray (10YR 3/1) silt loam; friable; moderate, thin, platy structure; slightly acid; clear, smooth boundary.

A2—14 to 25 inches, dark-gray (10YR 4/1) silt loam; gray (10YR 5/1) ped coatings; friable; moderate, thin,

platy structure; medium acid; abrupt, smooth boundary.

B21—25 to 35 inches, black (10YR 2/1) heavy silty clay loam to light silty clay; kneads to very dark gray (10YR 3/1); firm; moderate, fine, prismatic structure breaks to strong, fine, subangular blocky structure; thick continuous clay films; medium acid; clear, smooth boundary.

B22g—35 to 41 inches, very dark gray (5Y 3/1) to dark-gray (5Y 4/1), heavy silty clay loam to light silty clay; very firm; moderate, fine, subangular blocky structure; few, fine, distinct, dark yellowish-brown mottles; thick continuous clay films; slightly acid; gradual, smooth boundary.

B3g—41 to 50 inches, mottled dark-gray (5Y 4/1) and yellowish-brown (10YR 5/6) medium silty clay loam; firm; some vertical cleavage; slightly acid.

The A1 horizon commonly is black (10YR 2/1) or very dark gray (10YR 3/1) but may have a very dark brown (10YR 2/2) or very dark grayish-brown (10YR 3/2) overwash on the surface. If there is no overwash, the A1 horizon commonly varies between 8 and 10 inches in thickness. The A2 horizon ranges from 6 to 12 inches in thickness and generally is dark gray (10YR 4/1) but in places ranges to gray (10YR 5/1) or grayish brown (10YR 5/2). The B2 horizon is heavy silty clay loam to light silty clay. It ranges from black (10YR 2/1) or very dark gray (10YR 3/1) to dark gray (10YR 4/1) with depth.

Chelsea Series. The Chelsea series consists of coarse-textured soils that developed in noncalcareous material composed largely of fine and medium sand, which is predominantly quartz. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Regosols (Psammentic Normudalfs). They occur in a complex pattern on uplands near the Iowa River. The slope ranges from 2 to 40 percent. The native vegetation was trees.

The Chelsea soils have a dark grayish-brown, loose fine sand A horizon that is from 3 to 5 inches thick. They have a weakly developed, discontinuous B horizon consisting of thin, dark-brown horizontal bands of loamy fine sand. These bands occur between a depth of 2 and 4 feet and are redder and contain a little more clay than the interbands. The C horizon is yellowish-brown, loose fine sand. The reaction is strongly acid or medium acid.

The Chelsea soils are coarser textured and have a higher content of sand in the uppermost 3 feet than the Lamont soils. They are similar to the Hagener soils in texture but have a thinner A horizon and generally are more acid. In Iowa County, they commonly occur in association with the Fayette and Lamont soils and have been mapped as a Chelsea-Fayette-Lamont complex.

Profile of Chelsea fine sand, 200 feet south along TV Relay Tower road, 300 feet south-southeast of iron pipe marking boundary between Amana Colonies and private land in the NE¼NW¼SW¼ sec. 1, T. 80 N., R. 9 W., on a 7 percent slope, in a thick, forested area.

AO—1½ inches to 0, very dark gray (10YR 3/1) partially decomposed leaf litter; slightly acid; abrupt, smooth boundary.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) fine sand; gray (10YR 5/1) when dry; loose; abundant fine roots; single grain; medium acid; clear, smooth boundary.

B11—5 to 11 inches, dark-brown to brown (10YR 4/3) fine sand; loose; abundant tree roots; single grain; strongly acid; gradual, smooth boundary.

B12—11 to 22 inches, brown (10YR 5/3) fine sand; loose; common tree roots; single grain; strongly acid; gradual, smooth boundary.

B13—22 to 34 inches, yellowish-brown (10YR 5/4) fine sand; loose; single grain; strongly acid; gradual, smooth boundary; a 2-inch continuous band of dark-brown (7.5YR 4/4) loamy fine sand with weak, medium, subangular blocky structure occurs at a depth of 25 inches.

C1—34 to 44 inches, yellowish-brown (10YR 5/6) fine sand; loose; incoherent; single grain; occasional roots; dark-brown (7.5YR 4/4) wavy discontinuous bands up to ½ inch thick occur in this horizon; medium acid; gradual, smooth boundary.

C2—44 to 73 inches, brownish-yellow (10YR 6/6) fine sand; loose; incoherent; single grain; dark-brown (7.5YR 4/4) wavy discontinuous bands up to ½ inch thick occur in this horizon; medium acid.

The thickness and color of the A and Ap horizons vary considerably because the surface layer is susceptible to shifting both by wind and by rodents. The A horizon ranges from fine sand to loamy fine sand. In most places the depth to the bands of redder hue is 2 to 4 feet. The bands are typically loamy sand and are wavy and discontinuous. They commonly are ½ inch or less in thickness.

Clinton Series. The Clinton series consists of moderately well drained, Gray-Brown Podzolic soils (Typic Normudalfs) derived from loess. The slope ranges from 2 to 25 percent. Figure 8, page 7, shows the relationship of these soils to other soils in the county. The native vegetation consisted mainly of trees.

The Clinton soils have a very dark gray silt loam A1 horizon; a distinct grayish-brown to dark grayish-brown silt loam A2 horizon; a dark yellowish-brown, firm heavy silty clay loam B horizon in which there are distinct silt coats; and a light yellowish-brown silt loam C horizon. In cultivated areas, where the A2 is lacking, the Ap horizon is typically dark grayish brown.

These soils differ from the somewhat poorly drained Keomah soils in that their A2 horizon commonly is less distinct, and their B horizon has a chroma of 3 or higher and is not mottled at less than 30 inches from the surface. The Clinton soils have more clay in the B horizon than the Fayette soils and generally are more acid throughout the solum. They have a thinner, lighter colored A1 horizon and a more distinct A2 horizon than the closely associated Ladoga soils.

The Clinton soils are the forest-derived soils in the Otley, Ladoga, Clinton biosequence.

Profile of Clinton silt loam, 640 feet east and 50 feet north of the SW. corner of the SE¼ sec. 23, T. 79 N., R. 12 W., on a 7 percent convex slope, in a bluegrass pasture.

Ap—0 to 6 inches, very dark gray (10YR 3/1) silt loam; gray (10YR 5/1) when dry; friable; strong, fine, granular structure; few, weak, thin plates; slightly acid; clear, smooth boundary.

A2—6 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; 20 percent is dark yellowish brown (10YR 4/4); crushes to very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2); friable; moderate, fine, subangular blocky structure; some very weak horizontal cleavage; few gray (10YR 5/1, dry) silt grains on peds; slightly acid; gradual, smooth boundary.

B21—10 to 28 inches, dark yellowish-brown (10YR 4/4) medium to heavy silty clay loam; crushes to yellowish brown (10YR 5/4); firm; moderate, medium, subangular blocky structure; few light-gray (10YR 7/1, dry) silt grains on peds; few, thin, discontinuous clay films on some peds; few black oxide stains on peds; medium acid; clear, smooth boundary.

B22—28 to 38 inches, light yellowish-brown (10YR 6/4) medium to heavy silty clay loam; firm; strong, medium,

subangular blocky structure; light-gray (10YR 7/1, dry) silt grains on peds; few black oxide stains on peds; common thin clay films on many peds; medium acid; gradual, smooth boundary.

B3—38 to 54 inches, light yellowish-brown (10YR 6/4) medium to light silty clay loam; firm; weak, coarse, subangular blocky structure; light-gray (10YR 7/1, dry) silt grains on peds; few, fine, distinct, gray to light-gray (10YR 6/1) mottles inside peds; few black (10YR 2/1) oxide stains on peds; common, dark-colored, very fine, tubular pores; few thin clay films on vertical faces; medium acid; gradual, smooth boundary.

C—54 to 66 inches, light yellowish-brown (10YR 6/4) heavy silt loam to light silty clay loam; firm; massive, with some vertical cleavage; common, medium, distinct, gray (10YR 6/1) mottles, and common, fine, prominent, strong-brown (7.5YR 5/8) mottles; few fine concretions of black (10YR 2/1) oxide; common, dark-colored, very fine tubular pores; neutral.

If eroded, the A1 or Ap horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). The A1 horizon is from 2 to 4 inches thick. The A2 horizon is dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) and is from 4 to 8 inches thick. The color value of the B horizon is 4 or higher and increases with depth. The chroma is 3 or 4. Mottling occurs below a depth of 30 inches, but in places there are a few, fine, yellowish-brown mottles in the B2 horizon. The clay maximum of the B horizon ranges from 35 to 40 percent. The Clinton soils near the central part of the county generally have less clay in the B horizon than those near the southern part.

Colo Series. The Colo series consists of poorly drained Humic Gley (Wiesenboden) soils that are intergrading toward Alluvial soils (Cumulic Haplaquoll). These soils formed from moderately fine textured, water-laid sediments, along most of the streams in the county but mainly along the Iowa and English Rivers. Figure 4, page 4, shows their relationship to the other soils on bottom lands and terraces. The native vegetation was primarily grass.

These soils have a black light or medium silty clay loam A horizon, which is more than 20 inches thick, and a black to dark-gray medium or heavy silty clay loam subsoil, which commonly is mottled below a depth of 40 inches. The dark-colored soil, with a color value of 3 or lower, extends to a depth of 40 inches or more. Horizons are weakly defined. Colo silt loam, overwash, has from 4 to 20 inches of recent silty sediments over the black silty clay loam.

The Colo soils differ from the Bremer soils in having a thicker, blacker A horizon and a less well defined B horizon in which there are no clay films. They differ from the Zook soils in that they have a less clayey, less firm B horizon. The Colo soils are more poorly drained and finer textured than the Lawson soils.

Profile of Colo silty clay loam, 800 feet south and 100 feet west of the NE. corner of sec. 18, T. 79 N., R. 10 W., in a nearly level meadow.

A11—0 to 16 inches, black (10YR 2/1) light silty clay loam; friable; moderate, fine, granular structure; neutral; abrupt, smooth boundary.

A12—16 to 30 inches, black (N 2/0) medium or heavy silty clay loam; friable to firm; weak, very fine, subangular blocky structure; slightly acid; gradual, smooth boundary.

AB—30 to 36 inches, black (N 2/0) medium silty clay loam; firm; moderate, fine, subangular blocky structure; slightly acid; gradual, smooth boundary.

B2—36 to 43 inches, black (N 2/0) medium silty clay loam; firm; moderate, fine, prismatic structure; slightly acid; gradual, smooth boundary.

B3g—43 to 50 inches, very dark gray (N 3/0) light silty clay loam; friable to firm; weak, medium, prismatic structure; slightly acid; gradual, smooth boundary.

Cg—50 to 60 inches, gray to grayish-brown (2.5Y 5/1) light silty clay loam; friable to firm; few, fine, distinct, yellowish-brown (10YR 5/8) mottles; few fine concretions of very dark brown (10YR 2/2) oxide; massive; neutral.

The A horizon ranges from black to very dark gray. Both 10YR and neutral hues are common. The B horizon is weakly developed and is from 32 to 38 percent clay. The depth to colors with a value of 3 or higher commonly is nearly 40 inches but ranges to as little as 30 inches. Mottles that have a high value and chroma typically occur below a depth of 40 inches but may occur at a depth as shallow as 30 inches. The reaction is slightly acid or neutral.

Coppock Series. The Coppock series consists of somewhat poorly drained, weakly developed Planosols (Aquollic Argialbolls) that have a distinct, thick A2 horizon. These soils formed from alluvium, mainly on alluvial fans next to large stream terraces. The slope ranges from 0 to 3 percent. The native vegetation was water-tolerant prairie grasses.

The Coppock soils have a very dark brown to very dark grayish-brown, friable silt loam A1 horizon; a very dark gray or dark gray, mottled, friable silt loam A2 horizon that is more than 10 inches thick; and mottled gray, olive-brown, and yellowish-brown silty clay loam B and C horizons.

These soils differ from the Ely soil in having a thinner A1 horizon and distinct A2 horizons. They have much thicker, more discernible A2 horizons and commonly have finer textured B horizons than the Koszta soils. They have thicker A2 horizons and grayer B horizons than the Chariton soils. In addition, the content of clay is lower than that of the Chariton soils, and the depth to clay maximum is greater. The Coppock soils have thicker A2 horizons and less well developed and grayer B horizons than the Sperry soils.

Profile of Coppock silt loam, 95 feet west of road and 1,750 feet north of SE. corner of sec. 34, T. 79 N., R. 11 W., on a 3 percent slope, in an alfalfa-brome meadow.

A1—0 to 9 inches, very dark brown (10YR 2/2) silt loam; friable; moderate, fine, granular structure; neutral; clear, smooth boundary.

A21—9 to 13 inches, very dark gray (10YR 3/1) silt loam; kneads to dark gray (10YR 4/1); friable; moderate, thin, platy structure; common, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/4) mottles; medium acid; clear, smooth boundary.

A22—13 to 24 inches, dark-gray (10YR 4/1) silt loam; kneads to dark gray (10YR 4/1) to dark grayish brown (10YR 4/2); friable; weak, fine, subangular blocky structure; common, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/4) mottles; light-gray (10YR 7/1, dry) silt grains on peds; medium acid; gradual, smooth boundary.

B2—24 to 35 inches, gray (10YR 5/1) medium silty clay loam; kneads to dark grayish brown (10YR 4/2); friable to firm; weak, medium, prismatic structure breaks to moderate, medium, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) mottles, and few, fine, prominent, dark reddish-brown (2.5YR 3/4) mottles; light-gray (10YR 7/1, dry) silt grains on peds; thin continuous clay films;

few fine tubular pores; medium acid; gradual, smooth boundary.

B3—35 to 49 inches, gray (10YR 5/1) light or medium silty clay loam; kneads to brown (10YR 4/3) to olive brown (2.5Y 4/4); friable to firm; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) and dark-brown to brown (7.5YR 4/4) mottles; few fine concretions of dark reddish-brown (5YR 2/2) oxide; few fine tubular pores; medium acid; gradual, smooth boundary.

C—49 to 62 inches, mixed gray (10YR 5/1) and yellowish-brown (10YR 5/4) light silty clay loam; kneads to brown (10YR 5/3); friable to firm; massive with vertical cleavage; common fine concretions of black oxide and black oxide stains on vertical faces; slightly acid.

The A1 horizon ranges from 5 to 10 inches in thickness and from very dark gray (10YR 3/1) to very dark brown (10YR 2/2) in color. The A2 horizon ranges from 10 to 30 inches in thickness and in places has a few or common mottles. The clay maximum in the B horizon ranges from 30 to 36 percent. The depth to clay maximum is typically between 24 to 30 inches but ranges to as much as 40 inches.

Dickinson Series. The Dickinson series consists of well-drained or somewhat excessively drained Brunizems (Typic Hapludolls) that developed from moderately coarse textured materials. These soils occur on benches and uplands that parallel the Iowa River. The slope ranges from 0 to 9 percent. The native vegetation was prairie grasses.

These soils have a very dark brown, very friable sandy loam A horizon; a weakly defined, dark-brown to yellowish-brown, very friable sandy loam to loam B horizon; and a yellowish-brown loamy sand or sand C horizon. They typically are acid in the B horizon.

The Dickinson soils have sandy loam A and B horizons that are more retentive of moisture than the fine sand A and B horizons of the Hagener soils. They have coarser textured A and B horizons than the Waukegan soils.

Profile of Dickinson sandy loam, 550 feet south and 780 feet east of the NW. corner of sec. 5, T. 80 N., R. 9 W., in a nearly level cultivated field.

A1—0 to 15 inches, black (10YR 2/1) to very dark brown (10YR 2/2) sandy loam; very friable; weak, fine, granular structure; neutral; gradual, smooth boundary.

B1—15 to 24 inches, very dark grayish-brown (10YR 3/2) sandy loam; very friable; weak, fine, subangular blocky structure; medium acid; gradual boundary.

B2—24 to 30 inches, dark grayish-brown (10YR 4/2) to brown to dark-brown (10YR 4/3) sandy loam; very friable; weak, fine, subangular blocky structure; few, fine, faint, yellowish-brown (10YR 5/6) mottles; strongly acid; gradual, smooth boundary.

IIB31—30 to 38 inches, yellowish-brown (10YR 5/4) loamy sand; loose; single grain; strongly acid; gradual, smooth boundary.

IIB32—38 to 43 inches, brown (10YR 4/3 to 10YR 5/3) loam; friable; weak, fine, subangular blocky structure; few, fine, distinct, gray to light-gray (10YR 6/1) and strong-brown (7.5YR 5/6) mottles; strongly acid; clear, smooth boundary.

IIB3—43 to 52 inches, brown to dark-brown (10YR 4/3) loamy sand; loose; single grain; few, fine, distinct, gray to light-gray (10YR 6/1) and strong-brown (7.5YR 5/6) mottles; strongly acid.

The A horizon ranges from loamy sand to sandy loam in texture and from black (10YR 2/1) to very dark grayish brown (10YR 3/2) in color. It is from 10 to 20 inches thick. The B horizon is predominantly sandy loam but ranges to loam. In places fine sand occurs between 20 and 36 inches, and on some benches stratified layers of loam and fine sand occur below a depth of 36 inches.

Dinsdale Series. The Dinsdale series consists of well-drained Brunizems (Typic Argiudolls) that developed from 20 to 40 inches of loess over loam glacial till. These soils occur on gentle convex slopes on the uplands of the loess-mantled glacial till plain. The slope ranges from 2 to 9 percent. The A horizon and the upper part of the B horizon developed in loess, and the lower part of the B horizon and the C horizon developed in friable to firm glacial till. In places there is a layer of sandy sediments, several inches thick, immediately above the till. The native vegetation was prairie grasses.

The A horizon is very dark brown, friable light silty clay loam; the upper part of the B horizon is dark-brown friable silty clay loam; and the lower part of the B horizon and the C horizon are brown to yellowish-brown, friable to firm loam.

The Dinsdale soils have a thicker, darker colored A1 horizon than the Waubeek soils and generally have darker colored coatings in the B horizon. They differ from the Waukegan soils in having loam glacial till between a depth of 20 and 40 inches instead of sand, and they differ from the Kenyon soils in that they are more silty and less sandy in the A horizon and upper part of the B horizon. The Dinsdale soils that developed in 20 inches of loess are similar to the Kenyon soils, and the Dinsdale soils that developed in 40 inches of loess are similar to the Tama soils.

Profile of Dinsdale silty clay loam, 515 feet east and 45 feet south of the NW. corner of sec. 2, T. 81 N., R. 9 W., on a 3 percent convex slope in a meadow.

Ap—0 to 7 inches, black (10YR 2/1) light silty clay loam; kneads to very dark brown (10YR 2/2); friable; clods break to weak, fine, granular structure; slightly acid; abrupt, smooth boundary.

A12—7 to 12 inches, very dark brown (10YR 2/2) light silty clay loam; kneads to very dark grayish brown (10YR 3/2); friable; moderate, medium and fine, granular structure; strongly acid; clear, smooth boundary.

A3—12 to 17 inches, mixed very dark brown (10YR 2/2) and dark-brown (10YR 3/3) light silty clay loam; kneads to very dark grayish brown (10YR 3/2); friable; moderate, very fine, subangular blocky structure; strongly acid; clear, smooth boundary.

B1—17 to 27 inches, light or medium silty clay loam; dark brown (10YR 3/3) on exterior of peds, and brown to dark brown (10YR 4/3) on interior of peds; kneads to brown to dark brown (10YR 4/3); friable; thin continuous clay films; moderate, medium, subangular blocky structure; medium acid; clear, smooth boundary.

B21—27 to 31 inches, medium silty clay loam; brown to dark brown (10YR 4/3) on exterior of peds, and dark yellowish brown (10YR 4/4) on interior of peds; kneads to brown to dark brown (10YR 4/3); friable; moderate, medium, subangular blocky structure; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; medium acid; clear, smooth boundary.

IIB22—31 to 39 inches, brown (10YR 5/3) loam; kneads to brown (10YR 5/3); friable to firm; some stones and pebbles; moderate, medium, subangular blocky structure; common, fine, faint, olive-gray (5Y 5/2) mottles, and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; thin continuous clay films; medium acid; gradual, smooth boundary. At a depth of 34 inches there is a 1-inch zone of yellowish-brown (10YR 5/6) iron concentration.

IIB3—39 to 50 inches, mixed 60 percent dark yellowish-brown (10YR 4/4) and 40 percent gray to light-gray (10YR

6/1) loam; kneads to yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4); friable to firm; some pebbles; weak, coarse, subangular blocky structure; few, fine, prominent yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/6) mottles; thin discontinuous clay films; few concretions of yellowish-red (5YR 5/8) and strong-brown (7.5YR 5/8) oxide; medium acid; clear, smooth boundary. At a depth of 41 inches there is a 1½-inch zone of yellowish-brown (10YR 5/8) iron concentration.

IIC—50 to 65 inches, mixed 60 percent brown (10YR 5/3) and 40 percent gray to light-gray (10YR 6/1) loam; kneads to yellowish brown (10YR 5/4); friable to firm; some pebbles; massive; few, fine, prominent, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/8) mottles; few fine concretions of iron manganese; mildly alkaline.

The A1 horizon commonly is black (10YR 2/1) to very dark brown (10YR 2/2) but if eroded ranges to very dark grayish brown (10YR 3/2). The A horizon ranges from 12 to 20 inches in thickness. The sand content of the loess is 5 to 15 percent, but it may be higher near contact with the underlying glacial till. The loess ranges from 20 to 40 inches in thickness. The B horizon developed from loess and glacial till, and the clay maximum is less than 35 percent. The glacial till ranges from loam to light clay loam and commonly is leached or calcareous at a depth of about 45 inches. In places a zone of sandy sediments or pebbles occurs at the contact of the two-storied material.

Downs Series. The Downs series consists of well-drained soils that developed from loess. These soils have been classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Mollic Normudalfs). They are in the Fayette-Downs soil association and have a slope range of 2 to 18 percent. The native vegetation was prairie grasses, but the more recent vegetation was trees. Figure 5, page 5, shows their relationship to associated soils.

These soils have a very dark gray, friable silt loam A horizon; a dark grayish-brown A2 horizon, if uneroded; a dark-brown to brown, friable to firm silty clay loam B horizon in which there are some gray silt coats; and a yellowish-brown, friable silt loam C horizon. In cultivated areas, the Ap horizon commonly is very dark grayish brown, and generally the A2 horizon is lacking, but silt coats are evident in the B horizon. These soils are moderately permeable and have high moisture-holding capacity. They typically are medium acid or strongly acid in the most acid part of the solum.

The Downs soils occupy positions on the landscape similar to those occupied by the Ladoga soils of the Otley-Ladoga-Clinton soil association but they have less clay in the B horizon. They have a thicker A1 horizon than the Fayette soils and weaker structure in the B horizon. The Downs soils have a lighter colored A1 horizon than the Tama soils, and they have an A2 horizon which is lacking in the Tama soils. They have colors of higher chroma in the B horizon than the Atterberry soils but lack the mottling that is characteristic of those soils.

The Downs soils are the well-drained members of the toposequence that includes the somewhat poorly drained Atterberry soils and the poorly drained Walford soils. They are the prairie-forest transition members of the biosequence that includes the prairie-formed Tama soils and the forest-formed Fayette soils.

Profile of Downs silt loam, 70 feet south of pasture fence and 60 feet east of center of road in the SE¼SE¼ sec. 25, T. 81 N., R. 12 W., on a 3 percent convex slope, in a bluegrass pasture in which there are some scattered trees.

A1—0 to 7 inches, very dark gray (10YR 3/1) silt loam; kneads to very dark grayish brown (10YR 3/2); friable; weak, thin, platy structure; numerous fine roots; neutral; clear, smooth boundary.

A2—7 to 13 inches, mixed 80 percent dark grayish-brown (10YR 4/2) and 20 percent brown to dark-brown (10YR 4/3) silt loam; friable; weak, fine, subangular blocky structure with some horizontal cleavage; gray (10YR 6/1) silt grains on peds when dry; slightly acid; gradual, smooth boundary.

B1—13 to 18 inches, dark-brown (10YR 3/3) light silty clay loam; kneads to brown (10YR 4/3); friable; weak, fine, subangular blocky structure; gray (10YR 6/1) silt grains on peds when dry; few, fine, faint, yellowish-brown (10YR 5/4) mottles; slightly acid; gradual, smooth boundary.

B21—18 to 28 inches, dark-brown to brown (10YR 4/3) light or medium silty clay loam; kneads to brown (10YR 5/3); friable to firm; moderate, fine, subangular blocky structure; few, fine, faint, yellowish-brown (10YR 5/4) mottles; gray (10YR 6/1) silt grains on peds when dry; few, thin, discontinuous clay films; common fine tubular pores; medium acid; gradual, smooth boundary.

B22—28 to 37 inches, brown (10YR 5/3) light or medium silty clay loam; kneads to yellowish brown (10YR 5/4); friable to firm; moderate, medium, subangular blocky structure; gray (10YR 6/1) silt grains on peds when dry; few, fine, faint, yellowish-brown (10YR 5/6) mottles, and few, fine, distinct, gray (10YR 5/1) mottles in lower part; common, thin, discontinuous clay films; common fine tubular pores; few concretions of black oxide; strongly acid; gradual, smooth boundary.

B3—37 to 49 inches, brown (10YR 5/3) heavy silt loam; kneads to yellowish brown (10YR 5/4); friable; weak, coarse, subangular blocky structure; common, fine, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; common fine concretions of black oxide; few, thin, discontinuous, clay films; common fine tubular pores; strongly acid, gradual, smooth boundary.

C—49 to 60 inches, brown (10YR 5/3) silt loam; kneads to yellowish brown (10YR 5/4); friable; massive; common, fine, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; common fine concretions of black oxide; medium acid.

The color of the A1 horizon commonly is very dark gray (10YR 3/1) but ranges from very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2) in places. The A1 horizon is 4 to 8 inches thick. In cultivated areas, the A2 horizon may be lacking or mixed with the Ap horizon. The B2 horizon is light or medium silty clay loam and has a clay maximum of less than 35 percent. Color values in the B horizon range from 3 to 5 with depth. In places some gray mottles occur below a depth of 30 inches in the lower part of the B horizon and in the C horizon, but these are considered to be relict. Base saturation and pH increase with depth in the C horizon.

Ely Series. The Ely series consists of somewhat poorly drained soils that developed from local alluvium on fans and foot slopes. These soils have weak horizonation and have been classified as Brunizems (Aquic Cumulic Hapludolls). They have a slope range of 2 to 5 percent and are closely associated with the Colo and Nodaway soils, which occur in narrow drainageways downslope, and with Brunizems upslope. The native vegetation was prairie grasses.

The Ely soils have a black to very dark gray, friable silt loam A horizon, which is more than 20 inches thick, and a weakly developed, dark grayish-brown to grayish-

brown, mottled, friable light silty clay loam B horizon that is moderately permeable. In most places they are leached below a depth of 50 inches.

These soils differ from the Judson soils in that they are mottled and have colors of lower chroma in the B horizon. They have a thicker A horizon, weaker structural development, and less clay in the B horizon than the Nevin soils.

Profile of Ely silt loam, 245 feet east and 210 feet north of the SW. corner of the NW¼ sec. 36, T. 80 N., R. 11 W., on a 3 percent slope, in a cultivated area.

Ap—0 to 6 inches, very dark brown (10YR 2/2) heavy silt loam; friable; clods break to weak, fine, subangular blocky structure; natural; abrupt, smooth boundary.

A11—6 to 14 inches, black (10YR 2/1) heavy silt loam; friable; moderate, fine, granular structure; medium acid; gradual, smooth boundary.

A12—14 to 26 inches, black (10YR 2/1) heavy silt loam; kneads to very dark brown (10YR 2/2); friable; moderate, very fine, subangular blocky structure; few fine concretions of dark-brown (7.5YR 3/2) oxide; slightly acid; clear, smooth boundary.

A31—26 to 32 inches, black (10YR 2/1) to very dark gray (10YR 3/1) light silty clay loam; kneads to very dark brown (10YR 2/2); friable; weak, fine, prismatic structure breaks to weak, fine, subangular blocky structure; few fine concretions of dark-brown (7.5YR 3/2) oxide; slightly acid; gradual, smooth boundary.

A32—32 to 40 inches, very dark gray (10YR 3/1) light silty clay loam; kneads to very dark grayish brown (10YR 3/2); friable; weak, fine, prismatic structure breaks to moderate, fine, subangular blocky structure; common, fine, distinct, dark grayish-brown (2.5Y 4/2) mottles, and few, prominent, strong-brown (7.5YR 5/8) mottles; many fine pores; slightly acid; gradual, smooth boundary.

B2—40 to 49 inches, very dark gray (10YR 3/1) to dark gray (10YR 4/1) light silty clay loam; kneads to dark grayish brown (2.5Y 4/2); friable; weak, fine, prismatic structure breaks to weak, medium, subangular blocky structure; many, fine, distinct, grayish-brown (2.5Y 5/2) mottles, and common, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/8) mottles; few fine concretions of dark-brown (7.5YR 3/2) oxide; many fine pores; neutral; gradual, smooth boundary.

B3—49 to 58 inches, mixed grayish-brown (2.5Y 5/2) and dark-gray (10YR 4/1) heavy silt loam; kneads to grayish brown (2.5Y 5/2) to light olive brown (2.5Y 5/4); friable; weak, medium, prismatic structure breaks to weak, medium, subangular blocky structure; many, fine, distinct, yellowish-brown (10YR 5/4) mottles, and few, fine, distinct, strong-brown (7.5YR 5/8) mottles; few fine concretions of black oxide; few fine pores; neutral; gradual, smooth boundary.

C—58 to 65 inches, mixed yellowish-brown (10YR 5/6) and gray (5Y 5/1) silt loam; kneads to brown (10YR 5/3) to light olive brown (2.5Y 5/4); friable; massive; few, fine, distinct, strong-brown (7.5YR 5/8) mottles; common fine concretions of black oxide; neutral.

The A horizon ranges from 20 to 30 inches in thickness, from black (N 2/0) to very dark gray (10YR 3/1) in color, and from silt loam and light silty clay loam to loam in texture. In places there is some very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) overwash on the surface. The B horizon is predominantly light silty clay loam but ranges from heavy silt loam to medium silty clay loam. Horizon boundaries typically are gradual. The sand content ranges from 10 to 40 percent, depending on content of sand or silt in the soils upslope. The reaction is slightly or medium acid in the most acid part of the solum.

Fayette Series. The Fayette series consists of well-drained Gray-Brown Podzolic soils (Typic Normudalfs) that developed from loess. These soils occur principally in the northern third of the county, on slopes of 2 to 40 percent. Figure 5, page 5, shows their relationship to associated soils. The native vegetation was a mixed forest of hardwoods.

The Fayette soils have a thin, very dark gray, friable silt loam A1 horizon; a distinct, dark grayish-brown A2 horizon; a friable to firm silty clay loam B horizon in which there are distinct gray silt coats; and a yellowish-brown, friable silt loam C horizon. The reaction is medium to very strongly acid in the most acid part of the solum.

These soils occupy positions on the landscape similar to those occupied by the Clinton soils, which occur in the southern part of the county, but they have less clay in the B horizon. They have a thinner A1 horizon and a more distinct A2 horizon than the Downs soils and have stronger structure in the B horizon. In cultivated areas, the Ap horizon is lighter colored.

The Fayette soils are the well-drained members of the toposequence that includes the somewhat poorly drained Stronghurst soils. They are the forest-formed members of the biosequence that includes the forest-prairie transition Downs soils and the prairie-formed Tama soils.

Profile of Fayette silt loam, 1,240 feet south and 1,050 feet west of the NW. corner of sec. 25, T. 81 N., R. 12 W., on a 3 percent east-facing slope, in an oak-hickory type of forest.

AO—½ inch to 0, very dark brown (10YR 2/2) partly disintegrated, hardwood leaves and twigs; abrupt, smooth boundary.

A1—0 to 4 inches, very dark gray (10YR 3/1) friable silt loam; weak, thin, platy structure and fine granular structure; few brown to dark-brown (10YR 4/3) worm casts; very strongly acid; clear, smooth boundary.

A2—4 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; 10 percent is brown to dark brown (10YR 4/3), gray (10YR 6/1) when dry; friable; weak, thick, platy structure breaks to weak, fine, subangular blocky structure; silt grains on ped surfaces; very strongly acid; clear, smooth boundary.

B1—8 to 14 inches, dark grayish-brown (10YR 4/2) and brown to dark-brown (10YR 4/3) light silty clay loam; brown to dark-brown (10YR 4/3) interiors; friable; strong, fine, subangular blocky structure light brownish-gray (10YR 6/2, dry) silt grains on ped surfaces; very strongly acid; gradual, smooth boundary.

B21—14 to 24 inches, brown to dark-brown (10YR 4/3) light to medium silty clay loam; kneads to dark yellowish brown (10YR 4/4); friable to firm; strong, fine, medium, subangular blocky structure; few, thin, discontinuous, clay films; light brownish-gray (10YR 6/2, dry) silt grains on peds; strongly acid; gradual, smooth boundary.

B22—24 to 35 inches, brown to dark-brown (10YR 4/3) light silty clay loam; kneads to dark yellowish brown (10YR 4/4); friable to firm; few black (10YR 2/1) oxide stains on peds; strong, medium and coarse, subangular blocky structure; light-gray (10YR 7/1, dry) silt grains on peds; common, thin, discontinuous, clay films; strongly acid; gradual, smooth boundary.

B3—35 to 46 inches, yellowish-brown (10YR 5/4) light silty clay loam; friable; few fine concretions of black (10YR 2/1) oxide; weak, coarse, subangular blocky structure; light-gray (10YR 7/2, dry) silt grains on peds; few thin clay films on some peds; medium acid; gradual, smooth boundary.

C—46 to 58 inches, yellowish-brown (10YR 5/4) silt loam; friable; massive with some vertical cleavage; light-

gray (10YR 7/1, dry) silt grains on vertical faces; slightly acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to dark gray (10YR 4/1) in color and from 2 to 4 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) and is from 4 to 8 inches thick. In cultivated areas, it commonly is mixed with the plow layer. The Ap horizon generally is very dark grayish brown (10YR 3/2) to grayish brown (10YR 4/2). The B2 horizon has a clay maximum of less than 35 percent and ranges from light to medium silty clay loam. Some gray mottles occur in places below a depth of 30 inches in the lower part of the B horizon and in the C horizon, but these are considered to be relict. Base saturation and pH increase with depth in the C horizon.

Gara Series. The Gara series consists of moderately well drained soils that developed from clay loam glacial till. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Mollic Normudalfs). They occur on slopes of 5 to 25 percent and are downslope from the Ladoga or Clinton soils but upslope from soils in drainageways. The largest acreage is in the southern half of the county. Figure 8, page 7, shows their relationship to associated soils. The native vegetation consisted of prairie grasses and trees.

The Gara soils have a very dark gray, friable loam A1 horizon; a brown to yellowish-brown, friable to firm light or medium clay loam B horizon in which there are evident clay films, and also a few mottles in the lower part; and a yellowish-brown, mottled C horizon. These soils have moderately slow permeability and high water-holding capacity. They are strongly acid in the most acid part of the solum.

These soils have a lighter colored, thinner A1 horizon than the Shelby soils and have a weakly developed A2 horizon. They have a thicker A1 horizon and a less distinct A2 horizon than the Lindley soils.

The Gara soils are the prairie-forest formed members of the biosequence that includes the prairie-formed Shelby soils and the forest-formed Lindley soils.

Profile of Gara loam, 1,300 feet north and 260 feet east of the SW. corner of sec. 15, T. 80 N., R. 10 W., on an 11 percent convex slope, in a bluegrass pasture in which there are some scattered trees.

A1—0 to 8 inches, very dark gray (10YR 3/1) loam; friable; weak, fine, platy structure and fine, granular structure; few black (10YR 2/1) worm casts; neutral; clear, smooth boundary.

A2—8 to 12 inches, dark grayish-brown (10YR 4/2) loam; kneads to very dark grayish brown (10YR 3/2); friable; weak, coarse, platy structure breaks to weak, fine, subangular blocky structure; common very dark gray (10YR 3/1) worm casts; few gray (10YR 5/1) silt grains on peds, when dry; slightly acid; clear, smooth boundary.

B1—12 to 18 inches, brown to dark-brown (10YR 4/3) light or medium clay loam; friable to firm; moderate, fine and medium, subangular blocky structure; few very dark gray (10YR 3/1) worm casts; gray (10YR 5/1) silt grains on peds, when dry; few pebbles; medium acid; gradual, smooth boundary.

B2—18 to 30 inches, yellowish-brown (10YR 5/4) medium clay loam; friable to firm; moderate, medium, subangular blocky structure; few, fine, faint, yellowish-brown (10YR 5/8) mottles; thin patchy clay films; gray (10YR 5/1) silt grains on peds, when dry; few pebbles and stones; strongly acid; gradual, smooth boundary.

B3—30 to 47 inches, yellowish-brown (10YR 5/4) light clay loam; friable to firm; weak, medium and coarse, subangular blocky structure; few, fine, faint, yellowish-brown (10YR 5/8) mottles; gray (10YR 5/1) silt grains on peds, when dry; few pebbles and stones; strongly acid; gradual, smooth boundary.

C—47 to 60 inches, yellowish-brown (10YR 5/6) loam; kneads to yellowish brown (10YR 5/4); friable to firm; massive; common, fine, distinct, strong-brown (7.5YR 5/8), and grayish-brown (10YR 5/2) mottles; few concretions of black oxide; few pebbles and stones; neutral.

The A1 horizon is typically very dark gray (10YR 3/1) and is from 4 to 8 inches thick. In most areas the A horizon is loam, but in uneroded areas, near loess soils upslope, it commonly is gritty silt loam. Generally, the A2 horizon is from 2 to 4 inches thick and is weakly developed. In cultivated areas, it commonly is lacking. The B horizon has a maximum clay content of about 34 to 40 percent and is from 24 to 36 inches thick. The degree of mottling increases with depth below the B1 horizon. Mottles typically are strong brown, yellowish brown, grayish brown, and gray to olive gray. The reaction is strongly acid or medium acid in the most acid part of the solum.

Givin Series. The Givin series consists of somewhat poorly drained soils derived from loess. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Aquollic Normudalfs). They occur on nearly level tabular divides in the southern part of the county. Figure 8, page 7, shows their relationship to other soils in the county. The native vegetation was prairie grasses and trees.

These soils have a very dark gray silt loam A horizon; a dark gray silt loam A2; and a grayish-brown, mottled silty clay loam B horizon. They generally are acid throughout the solum.

The Givin soils have finer textured B and C horizons than the Atterberry soils and generally are more strongly acid in the solum. They differ from Mahaska soils in having an A2 horizon, and they differ from Keomah soils in having a thicker, darker colored A1 horizon and a less distinct A2 horizon.

The Givin soils are the prairie-forest transition of the Mahaska, Givin, and Keomah biosequence.

Profile of Givin silt loam, 480 feet east and 790 feet north of the SW. corner of the NW¼ sec. 33, T. 78 N., R. 10 W., in a meadow on a nearly level tabular divide.

Ap—0 to 7 inches, very dark gray (10YR 3/1) silt loam; gray (10YR 5/1) when dry; friable; weak, thin, platy structure in places but predominantly moderate, medium, granular structure; slightly acid; clear, smooth boundary.

A2—7 to 12 inches, very dark gray (10YR 3/1) and dark gray (10YR 4/1) silt loam; light gray (10YR 5/1) when dry; kneads to dark grayish brown (10YR 4/2); friable; moderate, thin, platy structure; strongly acid; clear, smooth boundary.

B1—12 to 18 inches, dark grayish-brown (10YR 4/2) medium silty clay loam; friable to firm; strong, fine, subangular blocky structure; few, fine, faint, brown to dark-brown (10YR 4/3) mottles; grayish-brown (10YR 5/2) ped coatings that are light gray (10YR 7/1) when dry; thin, continuous, clay films; strongly acid; clear, smooth boundary.

B2—18 to 27 inches, dark grayish-brown (2.5Y 4/2) heavy silty clay loam; kneads to olive brown (2.5Y 4/4); firm; moderate, medium, prismatic structure breaks

to moderate, medium, subangular blocky structure; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; grayish-brown (10YR 5/2) ped coatings which are light brownish gray (10YR 6/2) to white (10YR 8/1) when dry; thin, continuous, clay films; medium acid; gradual, smooth boundary.

B31—27 to 42 inches, grayish-brown (2.5Y 5/2) medium silty clay loam; firm; moderate, medium, prismatic structure breaks to weak, medium, angular blocky structure; thin continuous clay films; ped coatings of dark gray (10YR 4/1) and dark grayish brown (10YR 4/2); common, fine, distinct, dark yellowish-brown mottles; medium acid; gradual, smooth boundary.

B32—42 to 50 inches, grayish-brown (2.5Y 5/2) light silty clay loam; kneads to olive brown (2.5Y 4/4); friable; weak, coarse, prismatic structure breaks to weak, coarse, angular blocky structure; many, medium, distinct, strong-brown (7.5YR 5/6) mottles and few, fine, distinct, yellowish-brown (10YR 5/8) mottles; medium acid.

The A1 horizon ranges from black (10YR 2/1) to very dark gray (10YR 3/1) in color and from 4 to 8 inches in thickness. In most places the A2 horizon ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) in color and from 3 to 6 inches in thickness. The hue of the B horizon is 10YR to 2.5Y, and the color value is 4 in the upper part and grades to 5 in the lower part. The chroma generally is 2. The clay maximum ranges from medium to heavy silty clay loam. Mottles are evident below the A horizon and increase in size and abundance with depth.

Hagener Series. The Hagener series consists of Brunizems (Entic Hapludolls) that formed from fine eolian sand. These soils have very weak horizonation, are excessively drained, and are very droughty. They occur primarily on uplands and benches south of the Iowa River. The slope ranges from 0 to 25 percent. The native vegetation was primarily prairie grasses.

These soils are low in water-holding capacity, are very rapidly permeable, and are slightly acid or medium acid. They have a very dark grayish-brown fine sand A horizon, and they gradually increase in color value and in chroma to a yellowish-brown C horizon. The differences in color and texture of horizons are very gradual. Typically, iron bands are either not evident or are weakly expressed above a depth of 4 feet.

The Hagener soils are similar to the Chelsea soils, but they have a thicker, darker colored A horizon. They are coarser textured in the uppermost 3 feet than the Dickinson soils.

Profile of Hagener fine sand, 800 feet east and 115 feet south of the NW. corner of sec. 8, T. 80 N., R. 9 W., on a 7 percent convex slope, in a bluegrass pasture.

A1—0 to 9 inches, very dark grayish-brown (10YR 3/2) fine sand; loose; single grain; neutral; gradual, smooth boundary.

B1—9 to 23 inches, dark yellowish-brown (10YR 3/4) fine sand; loose; single grain; medium acid; gradual, smooth boundary.

B2—23 to 34 inches, dark yellowish-brown (10YR 4/4) fine sand; loose; single grain; medium acid; gradual, smooth boundary.

C—34 to 54 inches, light yellowish-brown (10YR 6/4) fine sand; loose; single grain; medium acid.

The A or Ap horizon varies considerably in thickness because the surface is susceptible to shifting either by wind or by rodent activity. The A horizon ranges from fine sand to loamy fine sand and is from 8 to 20 inches thick. The color of the B horizon is either very weak or is gradational between the A and C horizons. In some places the color value is 3 to a depth of 30 inches. Thin bands of strong-brown clay and iron occur at a depth below 3 feet in some areas. These bands are a few percent higher in content of clay than the interbands.

Hopper Series. The Hopper series consists of well-drained soils that formed from coarse, calcareous loess that contains about 10 to 20 percent of very fine sand. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Regosols (Dystric Eutrochrepts). They occur on long narrow ridges on the south side of the Iowa River, in Hilton and Lenox Townships. These ridges are oriented in a northwesterly to southeasterly direction and are known as pahas. The native vegetation was mainly trees.

The Hopper soils have a dark grayish-brown, very friable silt loam A horizon; a weakly defined, yellowish-brown, friable silt loam B horizon that has little structural development; and a yellowish-brown, friable silt loam C horizon that is neutral or mildly alkaline.

These soils differ from the Fayette soils in that they have less clay in the A and B horizons, have little or no structural development in the B horizon, and are less acid throughout the profile.

Profile of Hopper silt loam, 180 feet south and 870 feet east of the NW. corner of the NE¼NW¼ sec. 11, T. 81 N., R. 10 W., on a 15 percent convex slope, in a meadow.

Ap—0 to 8 inches, dark-brown to brown (10YR 4/3) silt loam; 15 percent is yellowish brown (10YR 5/4); kneads to dark yellowish brown (10YR 4/4); very friable; clods break to weak, fine, granular structure; neutral; clear, smooth boundary.

B2—8 to 16 inches, yellowish-brown (10YR 5/4) silt loam; kneads to yellowish brown (10YR 5/4 to 5/6); very friable; very weak, fine, subangular blocky structure; few fine tubular pores; neutral; gradual, wavy boundary.

B3—16 to 23 inches, yellowish-brown (10YR 5/4 to 5/6) silt loam; kneads to yellowish brown (10YR 5/4 to 5/6); very friable; very weak, coarse, subangular blocky structure; few, fine, light-gray concretions of lime; few, indistinct, gray (10YR 6/1, dry) silt grains on ped surfaces; mildly alkaline; gradual boundary.

C1—23 to 34 inches, yellowish-brown (10YR 5/6) light silt loam; very friable; massive; few, fine, strong-brown (7.5YR 5/8) mottles; calcareous and mildly alkaline; gradual, wavy boundary.

C2—34 to 60 inches, brown (10YR 5/3) light silt loam; kneads to light yellowish brown (10YR 6/4); friable; massive; few, fine, faint, yellowish-brown (10YR 5/8) mottles; common, fine, gray concretions of lime; calcareous and mildly alkaline.

In eroded areas, the A horizon ranges from 5 to 8 inches in thickness and from very dark grayish brown (10YR 3/2) to dark brown or brown (10YR 4/3) in color. The A and B horizons are silt loams but contain various amounts of fine sand and very fine sand. The weakly defined color B horizons are from 10 to 20 inches thick. In most places the depth to carbonates ranges from 20 to 40 inches.

Jackson Series. The Jackson series consists of moderately well drained or somewhat poorly drained soils that formed from silty alluvium. These soils are classified as Gray-Brown Podzolic soils (Aquic Normudalfs). They occupy nearly level areas on stream benches throughout the county and commonly are associated with the Bertrand soils. The native vegetation was trees.

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The Jackson soils have a very dark gray, friable silt loam A1 horizon; a dark grayish-brown, platy silt loam A2 horizon; a mottled brown and grayish-brown silty clay loam B horizon; and a light brownish-gray silt loam C horizon.

These soils have lighter colored, thinner A horizons than the Koszta soils, and they generally have a more distinct A2 horizon. In the Jackson soils, the B horizons have a chroma of 2 and are mottled, whereas in the Bertrand soils, the B horizons have a higher chroma and are not mottled. The Jackson soils have less clay in the B and C horizons than the Atterberry, Keomah, and Givin soils, and, although low in content of sand, they contain more sand than these loess-derived soils and, in places are stratified below a depth of 4 feet. They differ from the well-drained Watkins soils in that they have more distinct A2 horizons and have a chroma of 2 and some mottles in the B horizons.

The Jackson soils are the moderately well drained or somewhat poorly drained members of the toposequence that includes the well-drained Bertrand soils.

Profile of Jackson silt loam, 630 feet west of center of State Highway 149, and 450 feet north of Price Creek in the SE¼ sec. 22, T. 81 N., R. 9 W., in a nearly level cultivated field.

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) silt loam; friable; weak, medium, granular structure; neutral; abrupt, smooth boundary.

A2—6 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; friable; weak, medium, platy structure; many, fine, distinct, dark yellowish-brown (10YR 4/4) mottles, and few, fine, distinct, dark-brown to brown (7.5YR 4/4) mottles or soft oxides; neutral; clear, smooth boundary.

B1—11 to 18 inches, brown (10YR 4/3 to 10YR 5/3) light silty clay loam; kneads to brown (10YR 5/3); friable; weak, fine, subangular blocky structure; few, fine, faint, dark yellowish-brown (10YR 4/4) mottles; light brownish-gray (10YR 5/2, dry) ped coatings; neutral; gradual, smooth boundary.

B21—18 to 28 inches, light brownish-gray (10YR 6/2) light silty clay loam; kneads to yellowish brown (10YR 5/4); friable; moderate, medium, subangular blocky structure; light-gray (10YR 7/1, dry) ped coatings; many, fine, distinct, strong-brown (7.5YR 5/6) mottles; few fine concretions of iron and manganese; medium acid; gradual, smooth boundary.

B22—28 to 43 inches, grayish-brown (2.5Y 5/2) light to medium silty clay loam; kneads to brown (10YR 5/3); friable to firm; weak, medium, prismatic structure breaks to moderate, medium and fine, subangular blocky structure; many, fine, distinct, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/6) mottles; common fine concretions of iron and manganese; medium acid; gradual, smooth boundary.

B3—43 to 53 inches, grayish-brown (2.5Y 5/2) light silty clay loam; kneads to yellowish brown (10YR 5/4); friable; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; many, fine, prominent, strong-brown (7.5YR 5/6) mottles; common fine concretions of iron and manganese; medium acid; diffuse, smooth boundary.

C—53 to 70 inches, mixed 60 percent light brownish-gray (2.5Y 6/2) and 40 percent strong-brown (7.5YR 5/6) silt loam; kneads to light olive brown (2.5Y 5/4); friable; massive; few fine concretions of iron and manganese; slightly acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to dark gray (10YR 4/1) or very dark grayish brown (10YR 3/2) in color and from 2 to 5 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) in color and from 4 to 8 inches in thickness. The B2 horizon is predominantly light silty clay loam. In places the content of fine sand ranges from 5 to 15 percent in the solum. In the B horizon, the exterior of peds have a chroma of 2 or less, but the interior of peds have chromas of 3, 4, and 6. Mottles or soft concretions of an oxide occur in the A2 horizon. A few, fine, yellowish-brown to strong-brown mottles occur in the upper part of the B horizon and increase in number with depth. In places there are stratified layers of coarse-textured material below a depth of 4 feet.

Judson Series. The Judson series consists of well drained or moderately well drained soils that have weak horizonation. These soils are classified as Brunizems (Cumulic Hapludolls). They formed in local alluvium that washed from loess-derived Tama and Otley soils. They occur in slightly concave areas, mainly on foot slopes or alluvial fans throughout the county, between Brunizems on uplands and soils on bottom lands and terraces. The slope ranges from 2 to 6 percent. The native vegetation was chiefly prairie grasses.

The Judson soils have thick, dark-brown, friable silt loam A horizons that grade to a moderately developed dark-brown silty clay loam B horizon. They occupy positions on the landscape similar to those occupied by the imperfectly drained Ely soils, but they have browner A and B horizons than those soils and are free of gray mottling to a depth of 3 feet.

Profile of Judson silt loam, 920 feet east and 1,010 feet south of the NW. corner of sec. 15, T. 79 N., R. 9 W., on a 3 percent slope, in a meadow.

Ap—0 to 6 inches, very dark brown (10YR 2/2) silt loam; dark grayish brown (10YR 4/2) when dry; friable; moderate, fine, granular structure; slightly acid to neutral; clear, smooth boundary.

A12—6 to 25 inches, very dark brown (10YR 2/2) silt loam; friable; moderate, fine, granular structure; slightly acid; gradual, smooth boundary.

A3—25 to 38 inches, very dark grayish-brown (10YR 3/2) heavy silt loam to light silty clay loam; few, indistinct, grayish-brown (10YR 5/2) ped coatings when dry; friable; weak, fine, subangular blocky structure; medium acid; gradual, smooth boundary.

B—38 to 50 inches, very dark grayish-brown (10YR 3/2) to dark-brown (10YR 3/3) light silty clay loam; kneads to dark brown (10YR 3/3); friable; moderate, fine, subangular blocky structure; slightly acid.

The A horizon ranges from 20 to 36 inches in thickness and from black (10YR 2/1) to very dark brown (10YR 3/2) in color. In some areas recent dark grayish-brown (10YR 4/2) overwash is on the surface. The A horizon is silt loam but ranges from silt loam that is low in content of sand to silt loam that is high in content of sand. The B horizon is typically silty clay loam, but in some areas the upper part is heavy silt loam. The color value of the B horizon is 3 or 4 and the chroma is 2 grading to 3. Dark coatings commonly mask the brown ped interiors. Horizon boundaries are gradual or diffuse. In places a few yellowish-brown mottles occur below a depth of 36 inches, and in some places there are stratified layers of loamy material below a depth of 40 inches.

Kenyon Series. The Kenyon series is made up of moderately well drained Brunizems (Typic Hapludolls) that developed from medium-textured materials over loam glacial till. These soils occur on slopes of 2 to 14 percent

in the northeastern part of the county. The native vegetation was prairie grasses.

The Kenyon soils have a very dark brown loam to silt loam A horizon, and they have dark-brown loamy B and C horizons that contain a few stones and pebbles. The solum commonly is medium acid or strongly acid.

These soils differ from the Shelby soils in that they have more friable, less clayey B and C horizons; have a distinct stone line at contact with the IIB horizon; and are more strongly acid. They have a darker colored, thicker A1 horizon than the Bassett soils, and they lack the abrupt boundary to the lighter colored B horizon and also the distinct silt coats in the B horizon typical of the Bassett soils.

The Kenyon soils are the prairie members of the biosequence that includes the prairie-forest transition Bassett soils.

Profile of Kenyon loam, 590 feet east and 160 feet south of the NW. corner of the NE¼ sec. 3, T. 81 N., R. 9 W., on a 7 percent slope, in a meadow.

Ap—0 to 8 inches, very dark brown (10YR 2/2) loam; friable; clods break to weak, fine, granular structure; abundant fine roots; slightly acid; clear, smooth boundary.

A12—8 to 12 inches, very dark brown (10YR 2/2) loam; kneads to very dark grayish brown (10YR 3/2); friable; abundant roots; weak, fine, subangular blocky structure; strongly acid; gradual, smooth boundary.

B1—12 to 18 inches, brown to dark-brown (10YR 4/3) loam; some dark grayish-brown (10YR 4/2) ped coats; kneads to brown to dark brown (10YR 4/3); friable; few fine roots; moderate, fine, subangular blocky structure; strongly acid; clear, smooth boundary.

IIB21—18 to 29 inches, brown to dark-brown (10YR 4/3) loam; kneads to dark yellowish brown (10YR 4/4); friable to firm; stone line at depth of 18 to 20 inches; few fine roots; weak, medium, subangular blocky structure; strongly acid; gradual, smooth boundary.

IIB22—29 to 39 inches, brown to dark-brown (10YR 4/3) loam; kneads to dark yellowish brown (10YR 4/4); friable to firm; some stones and pebbles; weak, medium and coarse, subangular blocky structure; few, fine, faint, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; few fine concretions of black oxide; few fine roots; slightly acid; gradual, smooth boundary.

IIB3—39 to 51 inches, brown (10YR 5/3) loam; kneads to yellowish brown (10YR 5/4); friable to firm; weak, medium, prismatic structure breaks to moderate, coarse, subangular blocky structure; common, fine, prominent, gray (10YR 5/1) mottles, and common, fine, faint, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; few fine concretions of black oxide; slightly acid; gradual, smooth boundary.

IIC—51 to 60 inches, mixed brown (10YR 5/3) and gray (10YR 5/1) loam; kneads to brown (10YR 5/3); friable to firm; massive; common, fine, faint, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles, and few, fine, prominent, yellowish-red (5YR 5/8) mottles; few fine concretions of black and dark-brown oxide; neutral.

The uppermost 12 to 20 inches of the solum is typically lower in content of sand than the underlying till, and a layer of small pebbles and stones generally occurs between the two materials. The glacial till contains gravel and stones. The A1 horizon ranges from 12 to 15 inches in thickness and from black (10YR 2/1) to very dark brown (10YR 2/2) in color. The B horizon is predominantly loam, and it has a color value of 4 or 5 and a chroma of 3. A mottle-free zone, more than 12 inches thick, occurs immediately below the A horizon. The solum is typically medium acid or strongly acid in the most acid part. In places pockets or strata of sand to sandy loam occur within the solum.

Keomah Series. The Keomah series consists of somewhat poorly drained Gray-Brown Podzolic soils (Aquic Normudalfs) that developed from loess low in content of sand. These soils are closely associated with the Clinton soils. Figure 8, page 7, shows their relationship to associated soils. The native vegetation was a mixed forest of oak and hickory.

The Keomah soils have a dark-gray to dark grayish-brown, friable silt loam A1 horizon; a grayish-brown, platy, friable silt loam A2 horizon that contains a few mottles or soft oxides; a brown to grayish-brown, mottled, firm heavy silty clay loam to light silty clay B horizon; and a grayish-brown to yellowish-brown light silty clay loam to silt loam C horizon. There are distinct silt coats and clay films on peds in the B horizon.

The Keomah soils differ from the Clinton soils in that they generally contain some mottles and have colors of lower chroma in the upper part of the B horizon. They have more clay in the B horizon than the Stronghurst soils, and they have a lighter colored, thinner A1 horizon and a more prominent A2 horizon than the Givin soils.

The Keomah soils are the somewhat poorly drained members of the toposequence that includes the moderately well drained Clinton soils, and they are the forested members of the Mahaska, Givin, and Keomah biosequence.

Profile of Keomah silt loam, 620 feet west and 415 feet south of the center of sec. 28, T. 79 N., R. 9 W., in a nearly level alfalfa-timothy meadow.

Ap—0 to 7 inches, mixed dark grayish-brown (10YR 4/2) and dark-gray (10YR 4/1) silt loam; kneads to dark gray (10YR 4/1); friable; clods break to moderate, medium, platy structure; few, fine, faint, grayish-brown (10YR 5/2) mottles; neutral; clear, smooth boundary.

A2—7 to 14 inches, mixed 60 percent grayish-brown (10YR 5/2) and 40 percent dark-gray (10YR 4/1) silt loam; kneads to dark grayish brown (10YR 4/2); friable; moderate, thick, platy structure; few, fine, faint, dark-brown to brown (10YR 4/3) mottles; few dark-brown to brown (10YR 4/3) worm casts; light-gray (10YR 7/1) ped coatings when dry; slightly acid; clear, smooth boundary.

B21—14 to 22 inches, brown (10YR 5/3) heavy silty clay loam; kneads to brown (10YR 5/3) to light olive brown (2.5Y 5/4); firm; moderate, fine, subangular blocky structure; few, fine, distinct, strong-brown (7.5YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; light-gray (10YR 7/1) ped coatings when dry; few fine concretions of iron and manganese; thin continuous clay films; medium acid; gradual, smooth boundary.

B22—22 to 30 inches, brown (10YR 5/3) light silty clay; firm; weak, fine, prismatic structure breaks to strong, fine, subangular blocky structure; few, fine, distinct, strong-brown (7.5YR 5/6), dark yellowish-brown (10YR 4/4), and gray (10YR 5/1) mottles; many fine tubular pores; few small concretions of iron and manganese; thin continuous clay films; medium acid; gradual, smooth boundary.

B23—30 to 39 inches, brown (10YR 5/3) heavy silty clay loam; kneads to yellowish brown (10YR 5/4); firm; weak, medium, prismatic structure breaks to strong, medium, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6), strong-brown (7.5YR 5/6), and gray (10YR 5/1) mottles; many fine tubular pores; many common concretions of iron and manganese; thin continuous clay films; very strongly acid; gradual, smooth boundary.

B3—39 to 53 inches, grayish-brown (10YR 5/2) medium silty clay loam; kneads to light yellowish brown (10YR 6/4); slightly firm; moderate, coarse, angular blocky

structure; many, fine, distinct, yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/8) mottles; light-gray (10YR 6/1) ped coatings when dry; common concretions of iron and manganese; thin discontinuous clay films; strongly acid; diffuse, smooth boundary.

C—53 to 63 inches, grayish-brown (10YR 5/2) heavy silt loam to light silty clay loam; kneads to light yellowish brown (10YR 6/4); slightly firm; massive with some vertical cleavage; common concretions of iron and manganese; very strongly acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to dark gray (10YR 4/1) in color and from 3 to 6 inches in thickness. In cultivated areas, the Ap horizon generally is very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2). The A2 horizon is dark gray (10YR 4/1) to grayish brown (10YR 5/2) and is from 4 to 8 inches thick. It contains a few fine motttles or soft concretions of an oxide. In some places the A2 horizon has been incorporated into the Ap horizon. The B horizon has hues of 10YR to 2.5Y, values of 4 and 5, and chromas of 2 and 3. Soils that have a chroma of 3 in the upper part of the B horizon are commonly mottled. The B horizon generally is 30 to 39 inches thick and has a clay content ranging from 35 to 42 percent. The solum is medium acid or strongly acid in the most acid part.

KESWICK SERIES. The Keswick series consists of moderately well drained Gray-Brown Podzolic soils (Typic Normudalfs) that developed from exhumed late Sangamon paleosol. These soils occupy strongly dissected uplands and generally occur as bands on the sides of hills, between the Clinton and Lindley soils. They are mainly in the Clinton-Lindley-Gara-Keswick soil association. The slope ranges from 9 to 25 percent but is mostly about 15 percent. These soils have a fine-textured, plastic, strongly developed, paleosolic B horizon, which contains matrix or mottles commonly of 5YR, or redder, hue. The native vegetation was trees. Figure 8, page 7, shows the relationship of these soils to other soils in the county.

The Keswick soils have a very dark gray to dark grayish-brown, friable silt loam to loam A1 horizon; a dark-brown to dark grayish-brown, friable loam A2 horizon; and dark-brown to yellowish-red, mottled, firm clay loam to clay B horizon that contains some stones and pebbles.

These soils differ from the Adair soils in having a thinner, lighter textured A1 horizon and a discernible A2 horizon, if not eroded. They have a redder hue, a finer texture, and a more plastic B horizon than the Lindley and Gara soils. The Keswick series is the Gray-Brown Podzolic analogue of the Adair series.

Profile of Keswick loam, 300 feet south and 280 feet west of the NW. corner of the NE¼ sec. 26, T. 79 N., R. 12 W., on a 15 percent convex slope, in a bluegrass pasture.

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) loam or gritty silt loam; some peds of brown to dark brown (10YR 4/3); kneads to dark brown (10YR 3/3) to light brownish gray (10YR 6/2) when dry; friable; clods break to weak, fine, granular structure, and weak, thin, platy structure; slightly acid; abrupt, smooth boundary.

A2—6 to 13 inches, brown to dark-brown (10YR 4/3) loam; friable; moderate, fine, subangular and angular blocky structure, some horizontal cleavage; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few gray (10YR 6/1) distinct silt grains on peds when dry; medium acid; clear, smooth boundary.

IIP B21—13 to 19 inches, dark-brown to brown (7.5YR 4/4) light to medium clay loam; grayish-brown (10YR 5/2) ped coats; kneads to dark brown to brown (7.5YR 4/4); friable to firm; some pebbles; moderate, medium and fine, subangular and angular blocky structure; few, fine, distinct, yellowish-red (5YR 4/6) mottles; few distinct gray (10YR 6/1) silt grains on ped surfaces, when dry; thin nearly continuous clay films; medium acid; gradual, smooth boundary.

IIP B22—19 to 25 inches, yellowish-red (5YR 5/6) heavy clay loam to light clay; light brownish-gray (10YR 6/2) ped coats; kneads to yellowish red (5YR 5/6) to strong brown (7.5YR 5/6); firm; some pebbles; strong, medium, subangular blocky structure; few, fine, distinct, light-gray (10YR 7/1) blanched silt grains on ped surfaces, when dry; thick nearly continuous clay films; few fine concretions of black oxide; strongly acid; gradual, smooth boundary.

IIP B23—25 to 33 inches, strong-brown (7.5YR 4/6) heavy clay loam; grayish-brown (10YR 5/2) ped coats; firm; some pebbles; weak, coarse, prismatic structure breaks to strong, medium, subangular and angular blocky structure; few, fine, distinct, red (2.5YR 4/8) and yellowish-red (5YR 4/6) mottles; light-gray (10YR 7/1) blanched silt grains on ped surfaces, when dry; thick nearly continuous clay films; common fine concretions of black oxide; strongly acid; gradual, smooth boundary.

IIP B3—33 to 48 inches, dark yellowish-brown (10YR 4/4) light to medium clay loam; dark-brown to brown (10YR 4/3) coats on peds; firm; some stones and pebbles; weak, coarse, prismatic structure breaks to moderate, medium and fine, angular and subangular blocky structure; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; thin discontinuous clay films; common fine concretions of black oxide; slightly acid; gradual, smooth boundary.

IIC—48 to 65 inches, yellowish-brown (10YR 5/4) light clay loam; kneads to yellowish brown (10YR 5/4); firm; some stones and pebbles; massive with vertical cleavage; few, fine, distinct, grayish-brown (10YR 5/2) and strong-brown (7.5YR 5/6) mottles; stains of black oxide on cleavage planes; neutral.

The A1 or Ap horizon commonly is loam or gritty silt loam, except in severely eroded sites where it generally is clay loam. The A1 horizon ranges from very dark gray (10YR 3/1) in uneroded areas to very dark grayish brown (10YR 3/2), brown (10YR 4/3), and dark grayish brown (10YR 4/2) in cultivated or eroded areas. The A2 horizon is 4 to 8 inches thick and ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) in color but is lacking in some eroded areas. The B horizon ranges from dark brown (7.5YR 4/4) to yellowish red (5YR 4/6 to 5YR 5/6) in color and has mottles or mixed colors that range to 2.5YR in hue and from 2 to 8 in chroma. The B horizon is predominantly light clay but ranges from heavy clay loam to medium clay. Some stones and pebbles occur in this horizon and distinct silt coats are evident. A stone line generally occurs in the upper part of the B horizon. The solum is strongly acid or medium acid.

KOSZTA SERIES. The Koszta series consists of somewhat poorly drained soils that formed from medium-textured or moderately fine textured alluvium, low in content of sand. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Aquollic Normudalfs). They occur on nearly level stream benches, principally along the English and Iowa Rivers. The native vegetation was prairie grasses, but more recent vegetation was trees.

These soils have a very dark gray to very dark brown, friable silt loam A horizon; a dark grayish-brown, friable silt loam A2 horizon; and grayish-brown to gray, mottled silty clay loam B and C horizons.

The Koszta soils differ from the Amana soils in having a thinner A1 horizon and a dark grayish-brown A2 horizon. They differ from the Nevin soils in having a thinner A1 horizon, an A2 horizon, distinct silt coats on peds in the B horizon, and a more acid solum. The A2 horizon of the Koszta soils is thinner and less discernible than that of the Coppock soils, and generally their B horizon is not so fine textured. Their B3 and C horizons commonly are firmer and higher in content of clay than those of the Atterberry soils.

The Koszta soils are the prairie-forest members of the biosequence that includes the prairie-formed Nevin soils.

Profile of Koszta silt loam, 780 feet west and 770 feet south of the NE. corner fence post, in sec. 12, T. 78 N., R. 11 W.

Ap—0 to 9 inches, very dark brown (10YR 2/2) heavy silt loam; clods break to weak, fine, granular structure; friable to firm; neutral; abrupt, smooth boundary.

A2—9 to 14 inches, very dark grayish-brown (10YR 3/2) to dark grayish-brown (10YR 4/2) silt loam; 10 percent very dark gray (10YR 3/1) coats on plates; kneads to dark grayish brown (10YR 4/2); moderate, thin, platy structure breaks to weak, fine, granular structure; friable; few, fine, faint, dark yellowish-brown (10YR 3/4) mottles; few fine concretions of strong-brown (7.5YR 5/6) oxide; medium acid; clear, smooth boundary.

B1—14 to 23 inches, grayish-brown (10YR 5/2) light silty clay loam; ped exteriors have slightly lower value; kneads to grayish brown (10YR 5/2); friable; moderate, fine, subangular blocky structure; common, fine, district, yellowish-brown (10YR 5/6) mottles; few, fine, soft concretions of strong-brown (7.5YR 5/6) oxide; few fine tubular pores; medium acid; gradual, smooth boundary.

B21—23 to 29 inches, grayish-brown (2.5Y 5/2) light silty clay loam; kneads to grayish brown (10YR 5/2); weak, fine, prismatic structure breaks to moderate, fine, subangular blocky structure; friable; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; few, fine, hard concretions of black oxide; light-gray (10YR 7/1) silt grains on peds when dry; many fine tubular pores; strongly acid; gradual, smooth boundary.

B22—29 to 41 inches, medium silty clay loam; gray to light-gray (5Y 6/1) exterior coats mainly on prism faces; interior is mixed 60 percent gray to light gray (5Y 6/1) and 40 percent yellowish brown (10YR 5/6); kneads to grayish brown to light olive brown (2.5Y 5/3); moderate, medium, prismatic structure breaks to moderate, medium, subangular blocky structure; friable to firm; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few, fine, hard concretions of black oxide; thin discontinuous clay films on prism faces; light-gray (10YR 7/1) silt grains mainly on prism faces; many fine tubular pores; medium acid; gradual, smooth boundary.

B31—41 to 53 inches, medium slity clay loam; mixed matrix of gray (5Y 6/1) and yellowish brown (10YR 5/6) kneads to yellowish brown (10YR 5/4); few, thin, discontinuous, dark-gray (5Y 4/1) clay flows; weak, medium, prismatic structure breaks to moderate, medium, subangular blocky structure; friable to firm; few, fine, soft concretions of strong-brown oxide, and common, fine, hard concretions of black oxide; slightly acid; gradual, smooth boundary.

B32—53 to 62 inches, light silty clay loam; mixed matrix of gray (5Y 6/1) and yellowish brown (10YR 5/6); kneads to slightly more yellow hue; many dark-gray (5Y 4/1) vertical clay flows; massive with vertical cleavage; friable to firm; common, fine, hard concretions of black oxide; neutral.

The A1 horizon ranges from black (10YR 2/1) or very dark brown (10YR 2/2) to very dark gray (10YR 3/1) in color and from 4 to 8 inches in thickness. The A2 horizon ranges from 4 to 10 inches in thickness and the upper part commonly is grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2). The B horizon is light or medium silty clay loam. It has hues of 10YR to 2.5Y, when moist, values of 4 or 5, and a chroma of 2 that grades to 1 with depth. The chroma of 1 in the upper part of the B horizon is an exterior color and is due to the presence of grainy silt coats.

Ladoga Series. The Ladoga series consists of moderately well drained Gray-Brown Podzolic soils that are intergrading toward Brunizems (Mollic Normudalfs). These soils developed from loess that is low in content of sand. They formed under prairie grasses and trees and have moderate or moderately strong horizonation. Figure 3, page 3, shows their relationship to other soils in the county.

The Ladoga soils have a very dark brown, friable silt loam A horizon; an indistinct, very dark grayish-brown to dark grayish-brown A2 horizon; a brown to dark yellowish-brown silty clay loam B horizon that contains a few mottles at or below a depth of 30 inches; and a brown, friable silt loam to silty clay loam C horizon. In some eroded areas, the A2 horizon is lacking, but distinct silt coats are evident in the B horizon.

In uneroded areas, the Ladoga soils differ from the associated Otley soils in that their A1 horizon is thinner and coarser textured and their B2 horizon has angular blocky structure and contains distinct silt coats. They have a thicker, darker colored A1 horizon and a less distinct A2 horizon than the Clinton soils, and they have a higher content of clay in the B and C horizons than the Downs soils. They differ from the Givin soils in that they are less mottled and have a chroma of 3 in the B horizon.

The Ladoga soils form a toposequence with the Givin soils, and they are the transitional members of the Otley-Ladoga-Clinton biosequence.

Profile of Ladoga silt loam, 1,100 feet east and 150 feet north of the SW. corner of the NW¼SW¼ sec. 18, T. 78 N., R. 11 W., on a 2 percent convex slope, in a cultivated field.

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; grayish brown (10YR 5/2) when dry; friable; weak, fine, granular structure with a few, weak, thin, plates; neutral; abrupt, smooth boundary.

A2&B1—5 to 10 inches, mixed very dark grayish-brown (10YR 3/2) and dark grayish-brown (10YR 4/2) light silty clay loam; kneads to dark grayish brown (10YR 4/2); friable; moderate, fine and very fine, subangular blocky structure with some horizontal cleavage; slightly acid; gradual, smooth boundary.

B21—10 to 18 inches, brown to dark-brown (10YR 4/3) medium to heavy silty clay loam; friable to firm; moderate, fine, subangular and angular blocky structure; common, distinct, grayish-brown (10YR 5/2) silt coats; thin discontinuous clay films; medium acid; gradual, smooth boundary.

B22—18 to 27 inches, brown to dark-brown (10YR 4/3) medium to heavy silty clay loam; kneads to dark yellowish brown (10YR 4/4); friable to firm; moderate, medium, prismatic structure breaks to moderate, medium, subangular and angular blocky structure; common, distinct, brown (10YR 5/3) silt coats; thin clay films on many peds; medium acid; gradual, smooth boundary.

B31—27 to 44 inches, dark yellowish-brown (10YR 4/4) medium silty clay loam; friable; moderate, medium and coarse, subangular blocky structure; few very pale-brown (10YR 7/3, dry) silt coats on peds; some thin clay films on few peds; medium acid; diffuse, smooth boundary.

B32—44 to 50 inches, brown (10YR 5/3) silt loam to silty clay loam; kneads to dark yellowish brown (10YR 5/4); friable; massive with vertical cleavage; slightly acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to very dark brown (10YR 2/2) in color and from 4 to 8 inches in thickness. In eroded areas, the Ap horizon is very dark grayish brown (10YR 3/2). The A2 horizon ranges from very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) in color and from 2 to 4 inches in thickness, but it is lacking in some eroded areas. The B2 horizon has a clay maximum of 35 to 40 percent. There generally is less clay in the B horizon near the central part of the county than near the southern part. Color values grade from 3 to 5 with depth, and chromas of 3 are common in the B horizon. Some mottling generally is evident below a depth of 30 inches. Base saturation and pH increase with depth in the C horizon. The solum is medium acid or strongly acid in the most acid part.

LAMONT SERIES. The Lamont series consists of well-drained to excessively drained Gray-Brown Podzolic soils (Typic Normudalfs) that develop from moderately coarse textured eolian deposits of mixed mineralogy but dominantly of quartz. These soils occur in sloping to rolling areas, mainly near the Iowa River, which was a source of their parent material. In Iowa County, the Lamont soils are closely associated with the Chelsea and Fayette soils. They are the Gray-Brown Podzolic analogues of the Brunizemic Dickinson series.

The Lamont soils have a 3- to 6-inch dark grayish-brown, very friable sandy loam A1 horizon, and they have a yellowish-brown to brown, friable loam to sandy loam B horizon that is underlain by reddish-yellow sandy loam to loamy sand. They are strongly acid in the most acid part of the solum. In places thin bands of clay and iron are evident in the lower part of the B horizon or in the C horizon. The Lamont soils have finer textured B horizons than the Chelsea soils.

Profile of Lamont sandy loam, 325 feet north of the Amana dump, midway between two waterways in the NE¼ sec. 3, T. 80 N., R. 9 W., on a 5 percent north-facing slope, in a dense forest of oak and hickory.

A0—1 inch to 0, black (10YR 2/1) organic leaf mold and litter with mixed sand grains; neutral; abrupt, smooth boundary.

A1—0 to 3 inches, mixed dark-gray (10YR 4/1) and dark grayish-brown (10YR 4/2) sandy loam to loam; kneads to dark grayish brown (10YR 4/2); very friable; weak, fine, granular structure; single grain; abundant tree roots; medium acid; clear, smooth boundary.

A2—3 to 7 inches, dark grayish-brown (10YR 4/2) sandy loam; very friable; very weak, fine, subangular blocky structure; single grain; few, fine, prominent, dark-brown to brown (7.5YR 4/4) mottles; abundant tree roots; strongly acid; clear, smooth boundary.

B1—7 to 13 inches, dark-brown to brown (7.5YR 4/4) light loam to sandy loam; friable; weak, medium, subangular blocky structure; abundant tree roots; medium acid; clear, smooth boundary.

B2—13 to 24 inches, brown (7.5YR 5/4) loam; friable; weak, medium, subangular blocky structure; abundant tree roots; medium acid; gradual, smooth boundary.

B3—24 to 32 inches, reddish-yellow (7.5YR 6/6) sandy loam; friable; few concretions of dark-colored oxide; weak, coarse, subangular blocky structure; common tree roots; medium acid; gradual, smooth boundary.

C1—32 to 50 inches, reddish-yellow (7.5YR 6/6) sandy loam; very friable; thin bands of iron and manganese; single grain; medium acid, gradual, smooth boundary.

C2—50 to 60 inches, mixed reddish-yellow (7.5YR 6/6) and light-gray (10YR 7/1) loamy sand; very friable; thin bands of iron and manganese; single grain; strongly acid.

The A1 horizon ranges from very dark gray or very dark grayish brown (10YR 3/1 or 3/2) to dark gray or dark grayish brown (10YR 4/1 or 4/2) in color and from 3 to 6 inches in thickness. It is dominantly fine sandy loam but in places is sandy loam or loam. The B horizon ranges from dark yellowish brown and yellowish brown (10YR 4/4 and 5/4) to dark brown, brown, and strong brown (7.5YR 4/4, 5/4, and 5/6) in color and from sandy loam to loam in texture. In structure, it typically is weak, medium and coarse, subangular blocky. In places thin bands of clay and iron, less than 2 inches thick, are evident in the lower part of the B horizon or in the C horizon. The material between the bands is similar to that of the C horizon. The Lamont soils are medium acid or strongly acid in the most acid part of the solum. They generally are leached to a depth of 6 feet or more.

LAWLER SERIES. The Lawler series consists of somewhat poorly drained soils that developed from medium-textured alluvial material of moderate depth over fine and medium sands. These soils are classified as Brunizems (Aquic Hapludolls). They occur on nearly level benches along the Iowa River and its tributaries and in a small area on the uplands near Homestead. They are closely associated with the Waukegan and Udolpho soils. The native vegetation was prairie grasses.

The Lawler soils have a black, friable loam A horizon, and a dark grayish-brown, mottled loam B horizon that is underlain by yellowish-brown sand at a depth of about 40 inches. They are moderately permeable, and the water table is often high, especially in spring.

The Lawler soils differ from the Nevin soils in that they have more sand in the A and B horizons and have a sandy substratum at a depth of about 40 inches. They differ from the Waukegan soils chiefly in having a mottled B horizon that has a chroma of 2. They differ from the Udolpho soils in having a thicker A1 horizon and no A2 horizon.

Profile of Lawler loam, 710 feet east and 290 feet north of the SW. corner of the NW¼ of sec. 31, T. 81 N., R. 9 W., 1 mile east and ¾ mile north of South Amana, in a nearly level cultivated field.

A11—0 to 11 inches, black (10YR 2/1) loam; kneads to black (10YR 2/1) to very dark brown (10YR 2/2); friable; clods break to weak, fine, granular structure; neutral; gradual, smooth boundary.

A12—11 to 17 inches, very dark brown (10YR 2/2) loam; friable; very weak, fine, subangular blocky structure breaks to moderate, medium, granular structure; few, fine, faint, olive-brown (2.5Y 4/4) mottles; slightly acid; gradual, smooth boundary.

B1—17 to 24 inches, very dark grayish-brown (10YR 3/2) loam; friable; weak, fine, subangular blocky structure; few, fine, faint, olive-brown (2.5Y 4/4) mottles; few concretions of yellowish-red and black oxide, 1 to 5 millimeters in size; strongly acid; gradual, smooth boundary.

B21—24 to 33 inches, dark grayish-brown (2.5Y 4/2) mixed with 5 percent very dark gray (10YR 3/1) heavy loam; kneads to dark grayish brown ((10YR 4/2); friable; weak, medium, subangular blocky structure; few, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; few concretions of yellowish-red and black oxide, 1 to 5 millimeters in size; medium acid; gradual, smooth boundary.

B22—33 to 41 inches, dark grayish-brown (10YR 4/2) loam; kneads to brown to dark brown (10YR 4/3) to olive brown (2.5Y 4/4); friable; weak, medium, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; few concretions of yellowish-red and black oxide, 1 to 5 millimeters in size; medium acid; gradual, smooth boundary.

IIC1—41 to 52 inches, mixed gray (10YR 5/1) and dark yellowish-brown (10YR 4/4) loose fine sand; kneads to dark brown to brown (10YR 4/3); fine, single grain; few concretions of black oxide, 5 millimeters in size; medium acid; clear, smooth boundary.

IIC2—52 to 58 inches, mixed 60 percent gray (10YR 6/1) and 40 percent yellowish-brown (10YR 5/6) loose fine sand; kneads to brown (10YR 5/3); single grain; few concretions of black oxide, 5 millimeters in size; medium acid; clear, smooth boundary.

IIC3—58 to 75 inches, light-gray (10YR 7/1) loose fine sand; kneads to very pale brown (10YR 7/3); single grain; common, fine, faint, yellowish-brown (10YR 5/8) mottles; medium acid.

The A1 horizon ranges from 12 to 18 inches in thickness, but commonly there is a dark-colored transitional layer from the A1 horizon to the B2 horizon. The A1 horizon is black (10YR 2/1) to very dark brown (10YR 2/2). The A and B horizons are dominantly loam or gritty silt loam and do not contain stones or pebbles. The B horizon has a color value of 4 and a chroma of 2, and it has few or common mottles that increase in number with depth. Fine and medium sand occur at a depth between 30 and 45 inches. The solum is medium or strongly acid in the most acid horizons, and the underlying coarse-textured material is free of carbonates.

Lawson Series. The Lawson series consists of somewhat poorly drained soils that developed in medium-textured alluvium and that have weak horizonation. These soils are classified as Brunizems that are intergrading toward Alluvial soils (Aquic Cumulic Hapludolls). They are adjacent to the main channels along the English River and along Little Bear and Big Bear Creeks. Consequently, they are frequently dissected by old stream meanders and are subject to occasional overflow. The Lawson soils are closely associated with the Amana and Nodaway soils, and in some areas they are mapped as a complex with these soils. The native vegetation was prairie grasses and some scattered trees.

The Lawson soils are moderately permeable and have high moisture-holding capacity. They have a thick, black to very dark brown silt loam A horizon that gradually grades to dark grayish-brown silt loam in the B horizon. The soil horizons are weakly defined.

These soils are not so fine textured as the Colo soils, and they are better drained. They have a thicker dark-colored A horizon and are less acid than the Amana soils, and they are not so fine textured as the Ely soils.

Profile of Lawson silt loam, 375 feet north and 75 feet east of SW. corner of sec. 12, T. 80 N., R. 12 W., in a nearly level cultivated field 200 feet north of the bridge.

Ap—0 to 9 inches, black (10YR 2/1) to very dark brown (10YR 2/2) heavy silt loam; kneads to very dark brown (10YR 2/2); friable; clods break to weak, medium, granular structure; visible sand grains; neutral; clear, smooth boundary.

A12—9 to 24 inches, black (10YR 2/1) to very dark brown (10YR 2/2) heavy silt loam; kneads to very dark brown (10YR 2/2); friable, moderate, fine, granular structure; visible sand grains; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; occasional roots; slightly acid; gradual, smooth boundary.

A13—24 to 35 inches, mixed 80 percent very dark gray (10YR 3/1) and 20 percent dark yellowish-brown (10YR 3/4) heavy silt loam; kneads to very dark grayish brown (10YR 3/2); friable; weak, fine and medium, subangular blocky structure; visible sand grains; few, fine, prominent, strong-brown (7.5YR 5/6 to 7.5YR 5/8) mottles; neutral; gradual, smooth boundary.

B1—35 to 46 inches, dark-gray (10YR 4/1) heavy silt loam; kneads to dark gray (10YR 4/1) to dark grayish brown (10YR 4/2); friable; weak, medium, subangular blocky structure; visible sand grains; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; few fine concretions of iron and manganese; dark yellowish-brown (10YR 3/4) stains on ped surfaces; slightly acid; gradual, smooth boundary.

B2—46 to 68 inches, mixed 60 percent gray (10YR 5/1) and 40 percent dark-brown (10YR 3/3) gritty silt loam; kneads to dark grayish brown (10YR 4/2); friable; weak, coarse, prismatic structure breaks to weak, fine, subangular blocky structure; visible sand grains; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; slightly acid; clear, smooth boundary.

IIC—68 to 79 inches, mixed gray (10YR 5/1) and dark-brown (10YR 3/3) sandy loam; kneads to dark grayish brown (10YR 4/2); very friable; massive; slightly acid.

The A1 horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1) and is from 20 to 40 inches thick. The texture is silt loam, but in places the soil material contains from 5 to 20 percent fine sand. The B horizon is silt loam and has color values of 3 and 4 and a chroma of 2. A few mottles are evident in the A12 and A13 horizons and in the B horizon. The solum is neutral or slightly acid.

Lindley Series. The Lindley series consists of moderately well drained Gray-Brown Podzolic soils (Typic Normudalfs) that developed from clay loam glacial till during Wisconsin Age. These soils occur mainly in highly dissected areas adjacent to streams, on uplands that have a gradient of 9 to 40 percent. They are closely associated with the Keswick soils. Figure 8, page 7, shows their relationship to associated soils. The native vegetation was primarily mixed forest of oak and hickory.

These soils have a very dark grayish-brown, friable loam A1 horizon; a dark grayish-brown, friable loam A2 horizon; and brown to yellowish-brown, firm clay loam B and C horizons. Some clay has accumulated in the B horizon, and some grayish mottles are evident in the lower horizons. These soils generally are leached below a depth of 45 inches.

The Lindley soils have a thinner A1 horizon and generally a more pronounced A2 horizon than the Gara soils. They are less clayey in the B horizon than the Keswick soils, which have a redder hue or reddish mottles.

The Lindley soils are the forest-formed members of the biosequence that includes the prairie-formed Shelby soils and the prarie-forest formed Gara soils.

Profile of Lindley loam, 960 feet west and 200 feet south of the NE. corner of sec. 6, T. 78 N., R. 9 W., on a 15 percent convex slope, in a mixed cover of bluegrass and trees.

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) loam; friable; weak, fine, granular structure and weak, thin, platy structure; slightly acid; clear, smooth boundary.

A2—3 to 8 inches, dark grayish-brown (10YR 4/2) loam; light brownish gray (10YR 6/2) when dry; friable; weak, thin, platy structure; strongly acid; clear, smooth boundary.

B1—8 to 15 inches medium clay loam; brown (10YR 4/3 to 10YR 5/3) on interior of peds; firm; some pebbles; many light brownish-gray (10YR 6/2) to light-gray (10YR 7/2), distinct silt coats on peds when dry; moderate, fine, subangular and angular blocky structure; strongly acid; gradual, smooth boundary.

B2—15 to 25 inches medium to heavy clay loam; brown (10YR 5/3) on interior of peds; firm; hard when dry; some pebbles and stones; many, distinct, light brownish-gray (10YR 6/2) silt coats on peds when dry; strong, fine, subangular and angular blocky structure; thin nearly continuous clay films; strongly acid; gradual, smooth boundary.

B3—25 to 37 inches, yellowish-brown (10YR 5/4) medium clay loam; firm; some pebbles and stones; weak, coarse, subangular and angular blocky structure; few light brownish-gray (10YR 6/2) silt grains on peds when dry; few concretions of strong-brown and yellowish-red oxide; common concretions of black oxide; thin discontinuous clay films; medium acid; gradual, smooth boundary.

C—37 to 47 inches, yellowish-brown (10YR 5/6) light clay loam; firm; some stones and pebbles; massive with some vertical cleavage; few, fine, distinct, strong-brown (7.5YR 5/6) and grayish-brown (10YR 5/2) mottles; common concretions of black oxide; slightly acid.

If eroded the A1 horizon ranges from loam to clay loam in texture, from 2 to 4 inches in thickness, and from very dark gray (10YR 3/1) or dark gray (10YR 4/1) to very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) in color. The A2 horizon, which is distinct, is from 4 to 8 inches thick and is dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). Silt coats are evident on ped exteriors in the B horizon, and there are stones and pebbles in the B and C horizons. Where the Lindley soils are adjacent to loess-derived soils, the A horizon commonly is silt loam and the B horizon is dark-brown (10YR 4/4) to strong-brown (7.5YR 5/6) medium or heavy clay loam. In these areas, some stones and pebbles occur in the B horizon, and clay films are evident. Where the Lindley soils intergrade toward the Keswick soils upslope, the B horizon commonly is higher in content of clay and contains a few reddish mottles. The Lindley soils are mostly strongly acid or medium acid and commonly are leached below a depth of 50 inches. On some steep slopes, calcareous material is at a depth of only 30 inches.

MAHASKA SERIES. The Mahaska series consists of somewhat poorly drained Brunizems (Aquic Argiudolls) that developed from loess that contained less than 5 percent sand. These soils occupy nearly level tabular divides. Figure 3, page 3, shows their position on the landscape. The native vegetation was prairie grasses.

The Mahaska soils have a black light silty clay loam A1 horizon, and a dark grayish-brown, firm heavy silty clay loam B2 horizon that contains distinct thin clay films and some yellowish-brown and strong-brown mottles. The B32 horizon, at a depth of about 50 inches, is a grayish-brown silty clay loam to silt loam that contains many yellowish-brown mottles.

These soils differ from the Muscatine soils in that they are finer textured, have stronger structure, and have more clay films in the B horizon. They have a thicker A1 horizon than the Givin soils but lack the A2 horizon that is characteristic of these soils. They differ from the Otley soils in that they have hues of 2.5Y and a chroma of 2, and they are mottled in the B horizon. The Mahaska soils lack the strong gleying and the 5Y hues and 1 chroma in the B horizon that is typical of the Taintor soils.

The Mahaska soils are the somewhat poorly drained members of the toposequence that includes the moderately well drained Otley soils and the poorly drained Taintor soils.

Profile of Mahaska silty clay loam, 660 feet east and 700 feet south of the center of sec. 21, T. 80 N., R. 10 W., in a nearly level meadow.

Ap—0 to 6 inches, black (10YR 2/1) to very dark-brown (10YR 2/2) heavy silt loam to light silty clay loam; friable to firm; clods break to weak, fine, granular structure; neutral; abrupt, smooth boundary.

A12—6 to 15 inches, black (10YR 2/1) light silty clay loam; friable or firm; strong, fine, granular structure; slightly acid; clear, smooth boundary.

A3—15 to 20 inches, very dark gray (10YR 3/1) light silty clay loam; kneads to very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2); friable to firm; strong, very fine, subangular blocky structure; few, fine, faint, brown to dark-brown (10YR 4/3) mottles and few, fine, distinct, strong-brown (7.5YR 5/8) mottles; slightly acid; clear boundary.

B1—20 to 25 inches, very dark gray (10YR 3/1) and very dark grayish-brown (2.5Y 3/2) medium silty clay loam; kneads to very dark grayish brown (2.5Y 3/2); friable to firm; strong, fine, subangular blocky structure; few, fine, faint, dark yellowish-brown (10YR 4/4) mottles; slightly acid; gradual, smooth boundary.

B2—25 to 37 inches, dark grayish-brown (2.5Y 4/2) heavy silty clay loam; kneads to grayish brown (2.5Y 5/2); firm; moderate, fine and medium, subangular blocky structure; common, fine, distinct, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/6) mottles; thin continuous clay films; slightly acid; gradual, smooth boundary.

B31—37 to 49 inches light to medium silty clay loam; gray (5Y 5/1) on exterior of peds; kneads to grayish brown (2.5Y 5/2); firm; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; many, medium, distinct, yellowish-brown (10 YR 5/6) mottles, and few, fine, prominent, strong-brown (7.5YR 5/6) mottles; common fine concretions of black oxide; many dark-colored fine tubular pores; slightly acid; gradual, smooth boundary.

B32—49 to 73 inches, grayish-brown (2.5Y 5/2) heavy silt loam; gray (5Y 5/1) on vertical faces; friable; massive with vertical cleavage; many, fine, distinct, yellowish-brown (10YR 5/6) mottles, and many, fine, prominent, strong-brown (7.5YR 5/6) mottles; many fine concretions of black oxide; neutral.

The A1 horizon is black (10YR 2/1) to very dark brown (10YR 2/2) and ranges from 14 to 18 inches in thickness. In many places colors that have a value of 3 and chromas of 2 or less extend to a depth of 26 inches. The A1 horizon or the Ap horizon is predominantly light silty clay loam but ranges from heavy silt loam to medium silty clay loam. The B horizon typically has a hue of 2.5Y but commonly grades to a hue of 5Y. It has color values of 4 and 5, and a chroma of 2. Mottling occurs in the upper part of the B horizon and increases in the B3 horizons. The clay maximum ranges from 35 to 42 percent. The solum is slightly acid or medium acid in the most acid part.

MUSCATINE SERIES. The Muscatine series consists of somewhat poorly drained Brunizems (Aquic Argiudolls). These soils developed in thick loess that contained less than 5 percent sand. Although they have only moderate horizonation, all boundaries are distinct. These soils occur in nearly level or gently sloping areas, principally in the northern third of the county. Figure 5, page 5,

shows their relationship to associated soils. The native vegetation was prairie grasses.

The Muscatine soils have a black, friable light silty clay loam A horizon; a dark grayish-brown, mottled, friable to firm, light to medium silty clay loam B horizon that contains indistinct, thin clay films; and a gray, mottled silt loam C horizon. The C horizon is leached of carbonates. The solum is typically medium acid.

These soils occupy positions on the landscape similar to those of the Mahaska soils and are in the same drainage class, but their B horizon is not so fine textured The Muscatine soils have a thicker, darker colored A1 horizon and a somewhat darker brown B horizon than the Atterberry soils, and they lack the weakly defined A2 horizon that is typical of these soils. They are similar to the Nevin soils in some characteristics, but they have a lower content of sand throughout the solum; have less fine-textured, more friable B3 and C horizons; and lack the stratified layers of loam or silty clay loam that occur in the lower part of the B horizon and in the C horizon of some Nevin soils.

The Muscatine soils are the somewhat poorly drained members of the Tama-Muscatine toposequence.

Profile of Muscatine silty clay loam, 240 feet west and 20 feet south of the NE. corner of the SE¼NE¼ sec. 11, T. 80 N., R. 10 W., in a cornfield on a nearly level tabular divide, 1½ miles south of South Amana.

Ap—0 to 10 inches, black (10YR 2/1) light silty clay loam; friable; moderate, fine, granular structure; neutral; clear, smooth boundary.

A12—10 to 17 inches, black (10YR 2/1) to very dark gray (10YR 3/1) light silty clay loam; kneads to very dark gray (10YR 3/1); friable; moderate, fine, granular structure; medium acid; gradual, smooth boundary.

B1—17 to 25 inches, very dark gray (10YR 3/1) medium silty clay loam; kneads to dark grayish brown (10YR 4/2); friable; moderate, fine, subangular blocky structure; common, fine, distinct, grayish-brown (2.5Y 5/2) mottles, and few, fine, prominent, strong-brown (7.5YR 5/6) mottles; medium acid; gradual, smooth boundary.

B2—25 to 33 inches, dark grayish-brown (2.5Y 4/2) medium silty clay loam; kneads to grayish brown (2.5Y 5/2); friable to firm; moderate, fine, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; few fine concretions of black oxide; few thin discontinuous patchy clay films; medium acid; gradual, smooth boundary.

B3—33 to 46 inches, gray (10YR 5/1 to 5Y 5/1) light silty clay loam; kneads to light olive brown (2.5Y 5/4); friable to firm; weak, medium, subangular blocky structure; many, fine, distinct, yellowish-brown (10YR 5/6) mottles, and few, fine, prominent, strong-brown (7.5 YR 5/6) mottles; few concertions of black oxide; neutral; gradual, smooth boundary.

C—46 to 60 inches, gray (10YR 5/1 to 5Y 5/1) silt loam; kneads to light olive brown (2.5Y 5/4); friable; massive with some vertical cleavage; many, fine, distinct, yellowish-brown (10YR 5/6) mottles, and few, fine, prominent, strong-brown (7.5YR 5/6) mottles; common soft concretions of black oxide; neutral.

The A1 horizon is 14 to 18 inches thick and ranges from silty clay loam to silt loam in some places. The color of the A horizon is black (10YR 2/1) but grades to very dark gray (10YR 3/1) with depth. The interior of peds or the kneaded colors commonly have a value of 4 at a depth of 20 inches or more. The clay maximum of the B horizon is between 28 and 35 percent. Clay films are indistinct and generally are oriented on vertical faces of peds. The B horizon commonly has hues of 10YR to 2.5Y and a value of 4 that grades to 5 with depth. In the B horizon the chroma is 2 and mottling is common. Gray (5Y 5/1) or olive-gray (5Y 5/2) colors in the C horizon may be related to relict deoxidized loess. Soil reaction is medium acid or slightly acid in the most acid part of the solum. All horizon boundaries are gradual.

Nevin Series. The Nevin series consists of somewhat poorly drained Brunizems (Aquic Hapludolls) that developed from moderately fine textured alluvium on nearly level or gently sloping terraces along the English and Iowa Rivers and their tributaries. These soils may be flooded by runoff from soils upslope during periods of extremely high rainfall. Figure 4, page 4, shows their relationship to other soils in the county. The native vegetation was prairie grasses.

The Nevin soils have a black, friable light silty clay loam A horizon; a dark grayish-brown, mottled medium silty clay loam B horizon in which there are thin discontinuous clay films; and a grayish-brown, firm light to medium silty clay loam C horizon. Mottling increases in contrast and amount with depth.

The Nevin soils occupy positions similar to those occupied by the Koszta soils, and they have similar drainage, but they have a thicker, darker colored A horizon and have no silt ped coats in the B horizon. The Nevin soils are similar in texture and drainage class to the Muscatine soils on uplands, but they developed in alluvial material that is higher in content of sand, and their silty clay loam texture and firm consistence extends to a greater depth. They have a grayer, more mottled B horizon than the Wiota soils, and they lack the fine texture and the gleying in the B horizon that are typical of the Bremer soils.

Profile of Nevin silty clay loam, 230 feet east and 80 feet south of the NW. corner of the NE¼ sec. 7, T. 80 N., R. 11 W., in a nearly level cultivated field.

Ap—0 to 8 inches, black (10YR 2/1) light silty clay loam; friable; abundant fine roots; cloddy; neutral; abrupt boundary.

A12—8 to 14 inches, black (10YR 2/1) light silty clay loam; kneads to very dark brown (10YR 2/2); friable; moderate, fine, granular structure; medium acid; gradual, smooth boundary.

A3—14 to 20 inches, very dark grayish-brown (2.5Y 3/2) light silty clay loam; kneads to dark grayish brown (2.5Y 4/2); friable; weak, fine, subangular blocky structure; few, fine, faint, olive-brown (2.5Y 4/4) and grayish-brown (2.5Y 5/2) mottles; common fine tubular pores; medium acid; gradual, smooth boundary.

B21—20 to 27 inches, olive-gray (5Y 4/2) medium silty clay loam; kneads to dark grayish brown (2.5Y 4/2); firm; weak, fine, prismatic structure breaks to moderate, medium, subangular blocky structure; few, fine, prominent, yellowish-brown (10YR 5/6) mottles, and few, fine, faint, olive-brown (2.5Y 4/4) mottles; thin discontinuous clay films; few fine tubular pores; medium acid; gradual, smooth boundary.

B22—27 to 40 inches, olive-gray (5Y 5/2) medium silty clay loam; kneads to grayish brown (2.5Y 5/2); firm; moderate, medium and coarse, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) mottles, and common, fine, faint, olive-brown (2.5Y 4/4) mottles; few fine concretions of black oxide; medium acid; gradual, smooth boundary.

B3—40 to 50 inches, grayish-brown (2.5Y 5/2) light to medium silty clay loam; kneads to light olive brown (2.5Y 5/4); firm; weak, medium, subangular blocky structure; many, fine, prominent, yellowish-brown (10YR

5/6) and strong-brown (7.5YR 5/6) mottles; many fine concretions of black oxide; slightly acid; diffuse, smooth boundary.

C—50 to 60 inches, grayish-brown (2.5Y 5/2) light silty clay loam; kneads to light olive brown (2.5Y 5/4); firm; massive; many, fine, prominent yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; many fine concretions of black oxide; slightly acid.

The A1 horizon ranges from silt loam to light silty clay loam. The A horizons are black (10YR 2/1) and grade to very dark gray (10YR 3/1) to very dark grayish brown (2.5Y 3/2) with depth. Colors with a value of 3 and a chroma of 2 or less commonly extend to a depth of 24 inches or more. The clay content in the B horizon ranges from 30 to 36 percent. Moderately fine textures extend to a depth of 48 inches or more. The color of the B horizon varies from 2.5Y to 5Y in hue, with a value of 4 and 5, and a chroma of 2. Mottles are few or common below the A horizon but increase with depth. The lower part of the B horizon and the upper part of the C horizon are generally firm, but in places some sandy strata may occur below a depth of 48 inches. Soil reaction is medium acid to slightly acid in the most acid part of the solum.

NODAWAY SERIES. The Nodaway series consists of moderately well drained or somewhat poorly drained soils that developed from distinctly stratified, medium-textured alluvium, along most of the major streams in the county. These soils are classified as Alluvial soils (Typic Udifluvent). They are relatively young and, except for a darker colored Ap horizon in places, show no profile development. Layers of somewhat recent alluvial deposits can be seen in exposed vertical sections. The vegetation has not influenced soil development.

These soils have strata of very dark gray and grayish-brown silt loam that varies in thickness. A buried black or very dark gray soil generally occurs below a depth of 30 inches. The Nodaway soils have moderate or moderately slow permeability and high moisture-holding capacity. They are slightly acid in the most acid part of the profile.

The Nodaway soils differ from the Lawson and Amana soils in that they consist of strata of recently deposited, light-colored sediments, and they lack definite soil horizons.

Profile of Nodaway silt loam, 1,020 feet south and 50 feet west of the NE. corner of the NW1/4 sec. 32, T. 78 N., R. 11 W., in a nearly level bluegrass pasture, 30 feet from streambank of Gritter Creek, 3½ miles west of North English, Iowa.

C1–0 to 38 inches, alternating strata of very dark gray (10YR 3/1) silt loam, ½ inch to 2½ inches thick, and grayish-brown (2.5Y 5/2) silt loam, 1/32 to ¼ inch thick; few, fine, distinct, olive-brown (2.5Y 4/4) mottles in the very dark gray strata; friable; moderate, medium and thick, platy structure; neutral; clear, smooth boundary.

A1b—38 to 44 inches, very dark gray (10YR 3/1) silt loam; crushes to very dark grayish brown (10YR 3/2); friable; weak, fine, granular structure; neutral; clear, smooth boundary.

A12b—44 to 47 inches, stratified very dark gray (10YR 3/1), grayish-brown (10YR 4/2), and dark yellowish-brown (10YR 4/4) silt loam; crushes to very dark gray (10YR 3/1); friable; noticeable amounts of single-grain sand; weak, fine, granular structure; neutral; clear, smooth boundary.

B1b—47 to 63 inches, very dark grayish-brown (10YR 3/2) silt loam; friable; weak, medium, subangular blocky structure; neutral.

The surface horizon ranges from very dark gray to grayish brown (2.5Y 5/2) in color and is stratified. In some cultivated areas or areas protected from overflow, there is a discernible A horizon that has a color value of 3 or less and a chroma of 2 or less. The stratified material is silt loam. The depth to the buried dark-colored soil ranges from 20 to 40 inches. The buried soil is silt loam to light silty clay loam. Thin strata of sandy loam or loamy sand, generally less than 6 inches thick, occur in a few places. The reaction is slightly acid or neutral in the uppermost 36 inches or more.

OTLEY SERIES. The Otley series consists of moderately well drained Brunizems (Typic Argiudolls) that developed from thick loess, low in content of sand. These soils are downslope from the Mahaska soils and upslope from the Adair and Shelby soils. The slopes generally are long and convex and have a gradient of 2 to 18 percent. These soils are in the Otley-Ladoga-Clinton and the Ladoga-Otley-Adair-Shelby soil associations. A few areas occur on loess-covered benches along the English Rivers and their tributaries. Figure 3, page 3, shows their relationship to associated soils. The native vegetation was prairie grasses.

The Otley soils have a very dark brown, friable light silty clay loam A1 horizon; a brown, friable to firm heavy silty clay loam B horizon that has distinct clay films and is mottled in the lower part; and a yellowish-brown, friable silty clay loam to silt loam C horizon that contains grayish mottles. These soils have moderate horizonation, are moderately slowly permeable, and generally are medium acid in the most acid part of the solum.

The Otley soils occupy positions similar to those occupied by the Tama soils, but they differ from those soils in that they have stronger structure, a finer textured B horizon, and more distinct clay films and some mottling in the B horizon. They differ from the Ladoga soils in that they have a thicker, dark-colored A1 horizon, and they lack an A2 horizon and the distinct silt coats in the B horizon.

The Otley soils are the moderately well drained members of the toposequence that includes the somewhat poorly drained Mahaska soils and the poorly drained Taintor soils. They are the prairie-formed members of the biosequence that includes the forest-formed Clinton soils and the prairie-forest formed Ladoga soils.

Profile of Otley silty clay loam, 50 feet north and 260 feet east of the corner post in the SW. corner of sec. 1, T. 79 N., R. 11 W., in a meadow 4 miles west and 1 mile north of Williamsburg.

Ap—0 to 7 inches, black (10YR 2/1) to very dark gray (10YR 3/1) light silty clay loam, dark gray to gray (10YR 4/1 to 10YR 5/1) when dry; kneads to very dark brown (10YR 2/2); friable; clods break to weak, fine, granular structure; many fine roots; neutral; abrupt, smooth boundary.

A12—7 to 13 inches, very dark brown (10YR 2/2) light to medium silty clay loam; kneads to very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2); friable; moderate, fine, subangular blocky structure breaks to moderate, fine, granular structure; common fine roots; neutral; gradual, smooth boundary.

B1—13 to 18 inches medium silty clay loam; very dark grayish brown (10YR 3/2) on exterior of peds, and dark brown (10YR 3/3) on interior of peds; friable; moderate, fine, subangular blocky structure; few very dark gray (10YR 3/1) worm casts; slightly acid; gradual, smooth boundary.

B21—18 to 24 inches medium to heavy silty clay loam; dark brown to brown (10YR 4/3) on exterior of peds, and dark yellowish brown (10YR 4/4) on interior of peds; kneads to dark yellowish brown (10YR 4/4); friable to firm; moderate, fine, subangular blocky structure; many fine tubular pores in peds; medium acid; gradual, smooth boundary.

B22—24 to 31 inches medium to heavy silty clay loam; brown (10YR 5/3) on exterior of peds, and yellowish brown (10YR 5/4) on interior of peds; kneads to yellowish brown (10YR 5/4); friable to firm; few, fine, faint, strong-brown (7.5YR 5/6) mottles, and few, fine, faint, grayish-brown (10YR 5/2) mottles in lower part of horizon; moderate, medium and fine, subangular blocky structure; few, thin, patchy, dark yellowish-brown (10YR 3/4) clay films; many fine tubular pores in peds; few concretions of black oxide; medium acid; gradual, smooth boundary.

B31—31 to 42 inches medium silty clay loam; brown (10YR 5/3) on exterior of peds, and yellowish brown (10YR 5/4) on interior of peds; kneads to yellowish brown (10YR 5/4); friable to firm; few, fine, faint, strong-brown (7.5YR 5/6) and grayish-brown (2.5Y 5/2) mottles; moderate, medium, subangular blocky structure; few, thin, patchy, dark yellowish-brown (10YR 4/4) clay films; few, patchy, gray (10YR 6/1) grainy coats confined mainly to vertical part of peds; many fine tubular pores; few concretions of black oxide; medium acid; gradual, smooth boundary.

B32—42 to 56 inches, yellowish-brown (10YR 5/4) light silty clay loam; kneads to yellowish brown (10YR 5/4); friable to firm; many, fine, distinct, strong-brown (7.5YR 5/8) and grayish-brown (2.5Y 5/2) mottles; weak, medium, prismatic structure breaks to weak, coarse, subangular blocky structure; few, thin, patchy clay films; few, patchy, gray (10YR 6/1) grainy coats confined mainly to vertical faces; common, fine, soft concretions of dark reddish-brown (5YR 3/2) oxide; slightly acid; gradual, smooth boundary.

Cl—56 to 68 inches, yellowish-brown (10YR 5/4) heavy silty loam; friable; massive with vertical cleavage; few concretions of dark reddish-brown (5YR 3/2) oxide; neutral.

The A horizon typically ranges from black (10YR 2/1) to very dark brown (10YR 2/2) but is very dark grayish brown (10YR 3/2) in some eroded areas. If uneroded, the A1 horizon is light silty clay loam and is typically from 12 to 14 inches thick. The B horizon is medium to heavy silty clay loam. The color hues are centered on 10YR, and values of 4 and 5 with chromas of 3 and 4 are most common. The structure is moderate, and thin clay films are evident. A few grayish-brown (2.5Y 5/2) to olive-gray (5Y 5/2) mottles occur in places below a depth of 30 inches and increase in numbers in the C horizon. An olive-gray (5Y 5/2) zone, which is considered to be relict deoxidized loess, occurs below a depth of 48 inches in the C horizon. The C horizon commonly is light silty clay loam but grades to silty loam at a depth of about 80 inches. This soil is leached of carbonates to a depth greater than 80 inches. The solum ranges from slightly acid to medium acid in the most acid part.

Shelby Series. The Shelby series consists of moderately well drained Brunizems (Typic Argiudolls) that developed from clay loam glacial till during Wisconsin Age. These soils occur downslope from the Adair soils and upslope from soils along waterways. The slope ranges from 5 to 25 percent. Figure 3, page 3, shows the relationship of these soils to associated soils. The native vegetation was mainly prairie grasses.

The Shelby soils, if uneroded, have a very dark gray, friable loam A horizon; a dark-brown to yellowish-brown medium clay loam B horizon that contains thin, discontinuous clay films; and a yellowish-brown loam to clay loam C horizon that contains some mottles. Pebbles and small stones commonly occur throughout the solum. The reaction generally is medium acid.

The Shelby soils have a thicker A1 horizon than the Gara soils. They lack the A2 horizon that is typical of uneroded Gara and Lindley soils, and they are less acid than those soils and lack distinct silt coats in the B horizon. They differ from the Adair soils in that they have less clay in the B horizon and lack the reddish colors or mottles in the B horizon. The Shelby soils differ from the Kenyon soils in that they have more clay in the B horizon and commonly in the C horizon, lack the stone line that is typical of those soils, and are less acid.

The Shelby soils are the prairie-formed members of the biosequence that includes the forest-formed Lindley soils and the prairie-forest formed Gara soils.

Profile of Shelby loam, 690 feet east and 700 feet north of the SW. corner of the SW¼ of sec. 7, T. 79 N., R. 10 W., on an 11 percent convex slope, in a meadow.

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) loam; dark grayish brown (10YR 4/2) when dry; friable; some pebbles and stones; clods break to weak, fine, granular structure; slightly acid; clear, smooth boundary.

B1—5 to 12 inches, mixed matrix dark-brown (10YR 3/3) and dark yellowish-brown (10YR 4/4) loam; kneads to dark brown (10YR 3/3); friable; pebbles and some stones; moderate, very fine and fine, subangular blocky structure; medium acid; gradual, smooth boundary.

B21—12 to 25 inches, dark yellowish-brown (10YR 4/4) medium clay loam; firm; pebbles and some stones; moderate, fine, subangular blocky structure; medium acid; gradual, smooth boundary.

B22—25 to 35 inches, dark yellowish-brown (10YR 4/4) light clay loam; kneads to yellowish brown (10YR 5/4); firm; pebbles and some stones; weak, fine, subangular blocky structure; few thin discontinuous clay films; medium acid; gradual, smooth boundary.

B3—35 to 45 inches, yellowish-brown (10YR 5/4) loam to clay loam; firm; pebbles and stones; weak, coarse, prismatic structure; few, fine, faint, strong-brown (7.5YR 5/8) mottles; slightly acid.

The A horizon is typically loam, but it is clay loam in some eroded areas. Where loess soils occur upslope, the A horizon commonly is gritty silty clay loam. If uneroded, the A horizon is 12 to 14 inches thick and ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). The B horizon is medium to heavy clay loam and has color values of 4 or 5 and chromas of 3 or higher. In places a few yellowish-brown (10YR 5/4) to strong-brown (7.5YR 5/6) mottles are evident in the B horizon. The mottles generally increase in number and are more gray with depth. There are a few thin discontinuous clay films in the B horizon. Consistence is firm in the B and C horizons. The C horizon generally is clay loam but ranges to loam in places. Carbonates commonly occur below a depth of 48 inches. The solum is medium or slightly acid.

Sperry Series. The Sperry series consists of very poorly drained Planosols (Typic Argialbolls) that developed in loess, low in content of sand. These soils have strong horizonation. They occur in depressed areas, on broad upland divides throughout the county. These areas generally are only one acre or less in size. The native vegetation was marsh grasses.

The Sperry soils have a black to very dark gray, friable silt loam A1 horizon; a prominent, gray, friable silt loam A2 horizon; and a slowly permeable, very dark gray, firm heavy silty clay loam B horizon in which there are common yellowish-brown mottles and thick distinct clay films. The solum commonly is strongly acid. The Sperry soils in Iowa County are less clayey in the B horizon than is typical of its geographic area.

These soils differ from the Taintor soils in that they have a thinner, coarser textured A1 horizon and a prominent gray A2 horizon. They formed from loess and have slightly coarser textured B3 and C horizons than the Chariton soils, which are formed from alluvium. The Sperry soils have a thinner A2 horizon and darker coats in their more strongly developed B horizon than the Coppock soils.

Profile of Sperry silt loam, 30 feet west and 30 feet south of the NE. corner of the SE¼SE¼ sec. 21, T. 80 N., R. 10 W., in a slightly depressed cornfield.

Ap—0 to 7 inches, black (10YR 2/1) to very dark gray (10YR 3/1) silt loam; kneads to very dark gray (10YR 3/1); friable; massive; slightly acid; clear, smooth boundary.

A21—7 to 13 inches, dark-gray (10YR 4/1), silt loam; friable; medium, thin, platy structure; few, fine, distinct, olive-brown (2.5Y 4/4) and dark yellowish-brown (10YR 4/4) mottles; medium acid; clear, smooth boundary.

A22—13 to 19 inches, gray (10YR 5/1) silt loam; kneads to dark grayish brown (10YR 4/2); friable; weak, medium and fine, subangular blocky structure; few, fine, distinct olive-brown (2.5Y 4/4) and yellowish-brown (10YR 5/6) mottles; strongly acid; abrupt, smooth boundary.

B21—19 to 29 inches, dark-gray (10YR 4/1) heavy silty clay loam; very dark gray (10YR 3/1) ped coats; kneads to dark grayish brown (10YR 4/2 to 2.5Y 4/2); firm; weak, medium, prismatic structure breaks to moderate, fine, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) and brown (7.5YR 5/4) mottles; few fine root channels lined with very dark-gray (10YR 3/1) clay; thick continuous clay films; strongly acid; gradual, smooth boundary.

B22g—29 to 38 inches, dark-gray (5Y 4/1) heavy to medium silty clay loam; kneads to brown (10YR 5/3) to olive (5Y 5/3); firm; weak, medium, prismatic structure breaks to moderate, medium, subangular and angular blocky structure; common, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; few fine root channels lined with very dark gray (10YR 3/1) clay; thick continuous clay films; few fine tubular pores; slightly acid; clear, smooth boundary.

B31g—38 to 42 inches, mixed gray (5Y 5/1) and strong-brown (7.5YR 5/8) light silty clay loam; kneads to dark yellowish brown (10YR 4/4); friable to firm; weak, medium, prismatic structure breaks to moderate, medium, subangular and angular blocky structure; few fine root channels lined with very dark gray (10YR 3/1) clay; slightly acid; clear, smooth boundary.

B32g—42 to 50 inches, gray (5Y 5/1) light silty clay loam; kneads to gray; friable to firm; few, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; few fine root channels lined with very dark gray (10YR 3/1) clay; weak, coarse, subangular blocky structure; neutral; gradual, smooth boundary.

B33g—50 to 60 inches, gray (5Y 5/1) silt loam to silty clay loam; kneads to gray (5Y 5/1); friable to firm; massive with some vertical cleavage; few, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; neutral.

The A1 horizon is black (10YR 2/1) to very dark gray (10YR 3/1) and is from 6 to 10 inches thick. The A2 horizons are prominent, and are from 6 to 12 inches thick. They range from dark gray (10YR 4/1) to gray (10YR 5/1) in color, and have some mottles or concretions of an oxide. Peds in the upper part of the B horizon have dark-colored exteriors and grayer interiors. The B horizon ranges from heavy silty clay loam to light silty clay. The color ranges from dark gray (10YR 4/1) to gray (5Y 5/1) with depth, mottles are few or common, and clay films are thick and continuous. The Sperry soils in the southern part of the county contain more clay in the B horizon than the Sperry soils in the central part. The solum is medium or strongly acid in the most acid part.

Stronghurst Series. The Stronghurst series consists of somewhat poorly drained soils that developed in loess, low in content of sand. These soils are classified as Gray-Brown Podzolic soils (Aquic Normudalfs). They occur mainly on nearly level ridges on uplands in the northern part of the county and to a lesser extent on loess-covered benches along the Iowa River. They are closely associated with the Fayette soils. The native vegetation was mainly oak and hickory.

These soils have a dark-gray, friable silt loam A1 horizon; a dark grayish-brown, platy silt loam A2 horizon; and a grayish-brown to light olive-brown, mottled, friable to firm medium silty clay loam B2 horizon in which there are distinct silt coats and thin clay films. These soils generally are leached to a depth of more than 50 inches. They have moderately slow permeability and high moisture-holding capacity.

The Stronghurst soils differ from the Fayette soils in that they have colors of lower chroma and are mottled in the B horizon. They have less clay in the B horizon than the Givin soils and generally are less strongly developed. They differ from the Atterberry soils in that the A1 horizon is lighter colored and thinner, and the gray silt coats in the B horizon as a rule are more prominent. They have less clay and are less strongly developed in the B horizon than the Keomah soils. In the Stronghurst soils, the exterior of peds typically have a value of 5, but in the Atterberry soils, values of 3 and 4 occur in the upper part of the B horizon.

The Stronghurst soils are the somewhat poorly drained members of the toposequence that includes the well-drained Fayette soils. They are the forest members of the biosequence that includes the prairie-formed Muscatine soils and the prairie-forest formed Atterberry soils.

Profile of Stronghurst silt loam, 200 feet north and 210 feet west of the SE. corner of the SW¼SE¼ sec. 6, T. 81 N., R. 10 W., in a nearly level cultivated field.

Ap—0 to 8 inches, dark-gray (10YR 4/1) silt loam; kneads to dark grayish brown (10YR 4/2); friable; cloddy; neutral; abrupt, smooth boundary.

A2—8 to 13 inches, dark grayish-brown (10YR 4/2 to 2.5Y 4/2) silt loam; friable; weak, medium, platy structure; few, fine, faint, olive-brown (2.5Y 4/4) and yellowish-brown (10YR 5/6) mottles; few fine concretions of black oxide; slightly acid; abrupt, smooth boundary.

B21—13 to 22 inches, grayish-brown (2.5Y 5/2) medium silty clay loam; firm; moderate, fine, subangular blocky structure; few, fine, faint, olive-brown (2.5Y 4/4) and yellowish-brown (10YR 5/6) mottles; gray (10YR 6/1) silt coats on peds when dry; few fine concretions of black oxide; thin discontinuous clay films; strongly acid; gradual, smooth boundary.

B22—22 to 37 inches, grayish-brown (2.5Y 5/2) medium silty clay loam; kneads to brown (10YR 5/3); firm, moderate, medium, subangular blocky structure; gray (10YR 6/1) silt coats on peds when dry; common, fine, faint, yellowish-brown (10YR 5/6) mottles; thin continuous clay films; common fine concretions of black oxide; strongly acid; gradual, smooth boundary.

B3—37 to 49 inches, grayish-brown (2.5Y 5/2) light silty clay loam; kneads to brown to dark brown (10YR 4/3) to olive (5Y 5/3); friable to firm; weak, coarse, subangular blocky structure; many, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/8) mottles; few root channels coated with dark gray (10YR 4/1); many concretions of black oxide; thin discontinuous clay films; medium acid; gradual, smooth boundary.

C—49 to 57 inches, grayish-brown (2.5Y 5/2) silt loam; kneads to brown (10YR 4/3) or olive (5Y 5/3); friable; massive; many, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; many concretions of black oxide; slightly acid.

The A1 horizon ranges from 3 to 6 inches in thickness and from very dark gray (10YR 3/1) to dark gray (10YR 4/1) in color. The Ap horizon is dark gray (10YR 4/1) to dark grayish brown (10YR 4/2.) The A2 horizon has color hues of 10YR to 2.5Y, values of 4 and 5, and a chroma of 2, and it is from 4 to 8 inches thick. Mottling or soft concretions of an oxide are evident in the A2 horizon. The B horizons are grayish brown (2.5Y 5/2) to olive (5Y 5/3) and are light to medium silty clay loam. Mottles are common in the B horizon and increase in size and number with depth. Silt coats are more evident in the B21 horizon than in other parts of the B horizon, and clay films are more evident in the B22 horizon. The reaction is medium acid or strongly acid in the most acid part of the solum.

Taintor Series. The Taintor series consists of poorly drained Humic Gley soils (Typic Argiaquolls) that developed from loess, low in content of sand. These soils occupy level or slightly depressed areas on broad upland divides. The loess in these areas is about 18 feet thick. The native vegetation was prairie and marsh grasses.

These soils have a black silty clay loam A1 horizon; a slowly permeable, dark-gray to gray, mottled, firm heavy silty clay loam to light silty clay B horizon, in which there are distinct clay films; and a gray, mottled, silty clay loam to silt loam C horizon. Mottles increase in contrast and abundance with depth. The reaction generally is slightly acid.

The Taintor soils differ from the Mahaska and Muscatine soils by having hues of 5Y and a chroma of 1 in the upper part of the B horizon. They have more clay in the B horizon than the Muscatine soils, and they differ from the Bremer soils in that they have thick continuous clay films in the B horizon, are less firm in the B3 and C horizons, and are not stratified below a depth of 45 inches.

The Taintor soils are the poorly drained members of the toposequence that includes the somewhat poorly drained Mahaska soils and the moderately well drained Otley soils.

Profile of Taintor silty clay loam, 1,150 feet east and 100 feet north of the SW. corner of the SE¼ sec. 21, T. 80 N., R. 10 W., in a slightly depressed alfalfa-brome meadow.

A1—0 to 16 inches, black (10YR 2/1) light silty clay loam; friable to firm; moderate, fine, granular structure; medium acid; gradual, smooth boundary.

A3—16 to 20 inches, black (10YR 2/1) to very dark gray (10YR 3/1) light silty clay loam; kneads to very dark gray (10YR 3/1); friable to firm; moderate, very fine, subangular blocky structure; medium acid; clear, smooth boundary.

B1—20 to 25 inches, very dark gray (10YR 3/1) heavy silty clay loam; kneads to very dark grayish brown (2.5Y 3/2); firm; moderate, medium, prismatic structure breaks to strong, fine, subangular and angular blocky structure; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; thick continuous clay films; slightly acid; clear, smooth boundary.

B2g—25 to 36 inches, mixed dark-gray (5Y 4/1) and dark grayish-brown (2.5Y 4/2) heavy silty clay loam to light silty clay; kneads to grayish brown (2.5Y 5/2); firm; moderate, medium, prismatic structure breaks to strong, medium, subangular and angular blocky structure; few, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; thick continuous clay films; few fine concretions of black oxide; common, black, fine tubular pores in peds; slightly acid; clear, smooth boundary.

B3g—36 to 47 inches, gray (5Y 5/1) medium silty clay loam; crushes to olive gray (5Y 5/2); friable to firm; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; thin continuous clay films; few fine concretions of black (10YR 2/1) oxide, and patches of very dark-gray (10YR 3/1) stains on faces of peds; many, black, fine tubular pores in peds; common, medium, prominent, yellowish-brown (10YR 5/8) mottles; neutral; gradual, wavy boundary.

Cg—47 to 65 inches, gray (5Y 5/1 to 5Y 6/1) silty clay loam to silt loam; kneads to olive (5Y 5/3); massive with few vertical faces; many, medium, prominent, yellowish-brown (10YR 5/8) mottles; common fine concretions of black oxide; friable; few very dark gray (10YR 3/1) stains of iron and manganese on vertical faces; mildly alkaline.

The A1 horizon is light silty clay loam and ranges from black (N 2/0 to 10YR 2/1) in color and from 15 to 20 inches in thickness. The B horizons are distinctly gleyed and have a hue of 5Y, values of 4 or 5, and a chroma of 1. Mottles occur immediately below the A horizon and increase in size and number with depth. Clay films are thin to thick but continuous in the B horizon. The B horizon ranges from heavy silty clay loam to light silty clay. The Taintor soils generally are slightly acid but in some places are medium acid in the upper horizons. They are leached of carbonates below a depth of 48 inches.

Tama Series. The Tama series consists of well-drained Brunizems (Typic Argiudolls) that developed from loess, low in content of sand. These soils occur on convex slopes of 2 to 18 percent. Figure 5, page 5, shows their relationship to associated soils. The native vegetation was prairie grasses.

The Tama soils have a black to very dark brown, friable light silty clay loam A horizon; a dark-brown to brown, friable or firm medium silty clay loam B horizon; and a yellowish-brown, friable silt loam C horizon. These soils typically are free of mottling in the uppermost 30 inches and are slightly or medium acid. They are moderately permeable and have high moisture-supplying capacity.

The Tama soils occupy positions on the landscape similar to those occupied by the Otley soils, but they have a less fine textured B horizon. They differ from the Downs soils in that they have a darker colored and thicker A1 horizon, lack an A2 horizon, and have somewhat darker colors in the B horizon. They differ from the Muscatine soils in that they have chromas of 3 or higher in the B horizon and lack the mottling in the upper part of the B hori-

zon. The B and C horizons of the Tama soils developed from loess, whereas the B horizons of the Dinsdale soils developed from loess and glacial till. The Kenyon soils formed from loamy glacial till.

The Tama soils are the well drained members of the toposequence that includes the somewhat poorly drained Muscatine soils. They are the prairie members of the biosequence that includes the prairie-forest transition Downs and the forest-formed Fayette soils.

Profile of Tama silty clay loam, 600 feet west and 30 feet south of the NE. corner of sec. 1, T. 80 N., R. 12 W., on a 3 percent convex slope, in a cornfield.

Ap—0 to 9 inches, black (10YR 2/1) to very dark brown (10YR 2/2) light silty clay loam; kneads to very dark brown (10YR 2/2); friable; clods break to weak, medium, granular structure; medium acid; clear, smooth boundary.

A3—9 to 15 inches, very dark grayish-brown (10YR 3/2) light silty clay loam; friable; moderate, fine, subangular blocky structure; medium acid; clear, smooth boundary.

B1—15 to 23 inches, dark-brown (10YR 3/3) light silty clay loam; kneads to dark brown to brown (10YR 4/3); friable; weak, very fine, subangular blocky structure; few very dark brown (10YR 2/2) worm casts; medium acid; gradual, smooth boundary.

B21—23 to 32 inches, dark-brown to brown (10YR 4/3) medium silty clay loam; kneads to dark yellowish brown (10YR 4/4); friable to firm; moderate, medium, subangular blocky structure; thin discontinuous clay films; medium acid; gradual, smooth boundary.

B22—32 to 43 inches, dark-brown to brown (10YR 4/3) light silty clay loam; kneads to yellowish brown (10YR 5/4); friable to firm; moderate, medium and coarse, subangular blocky structure; thin discontinuous clay films; medium acid; gradual, smooth boundary.

B3—43 to 52 inches, brown (10YR 5/3) heavy silt loam; kneads to yellowish brown (10YR 5/4); friable; weak, coarse, subangular blocky structure; few, fine, faint, brownish-yellow (10YR 6/8) mottles and few, fine, distinct, yellowish-brown (10YR 5/8) mottles; few dark-colored oxide stains; slightly acid; gradual, smooth boundary.

C—52 to 67 inches, yellowish-brown (10YR 5/4) heavy silt loam; friable; massive; few, fine, faint, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; slightly acid.

The A1 horizon ranges from black (10YR 2/1) to very dark brown (10YR 2/2) in color, from 8 to 15 inches in thickness, and from light silty clay loam to silt loam in texture. The B horizon contains from 30 to 35 percent clay, and it has color values of 3 to 5 and chromas of 3 or 4. In places mottling occurs below a depth of 30 inches. Gray mottles in the lower part of the solum are considered to be relict. In places clay films are thin and discontinuous, and in others they are nearly lacking. In some more strongly sloping areas, the clay maximum is in the lower part of the A horizon. The Tama soils are typically medium acid but may be slightly acid below a depth of 30 inches. They are leached of carbonates to a depth of 48 inches or more.

TELL SERIES. The Tell series consists of well-drained or somewhat excessively drained Gray-Brown Podzolic soils (Typic Normudalfs) that developed in highly silty sediments and are low in content of sand in the upper part of the solum. These soils are underlain by fine and medium sand at a depth of 24 to 40 inches. Most of the acreage in the county occurs in the extreme northern part of Hilton and Iowa Townships, and a few areas are scattered along Price Creek in Lenox Township. These soils have a slope range of 2 to 14 percent. They are about 20 feet higher in elevation than adjoining soils on benches along the Iowa River and from 20 to 30 feet lower than soils on uplands to the south. The native vegetation was trees.

The Tell soils are moderately rapidly permeable and generally are acid throughout. They have a very dark gray, friable silt loam A1 horizon; a grayish-brown, friable, platy silt loam A2 horizon; and a brown to yellowish-brown light silty clay loam B horizon. Yellowish-brown or brownish-yellow sand occurs at a depth between 24 and 40 inches.

These soils are similar to the Fayette soils in color and texture but are underlain by fine sand at a depth of 24 to 40 inches. They differ from the Lamont soils in having a lower content of sand in the A horizon and upper part of the B horizon and in having more strongly developed structural peds in the B horizon. They differ from the Waukegan soils in that they have an A2 horizon, are lower in content of sand in the A horizon and upper part of the B horizon, and generally are more acid in the solum.

Profile of Tell silt loam, 735 feet west of Amana dump, in the NE¼ sec. 3, T. 80 N., R. 9 W., on a 3 percent convex slope, in a forest of oak and hickory.

AO—1 inch to 0, black (10YR 2/1) well-decomposed organic leaf mold and litter; abundant fine tree roots; neutral; abrupt, smooth boundary.

A1—0 to 6 inches, very dark gray (10YR 3/1) silt loam, with fine sand grains; friable; moderate, medium, granular structure; tree roots abundant; slightly acid; clear, smooth boundary.

A2—6 to 10 inches, dark-gray (10YR 4/1) to dark grayish-brown (10YR 4/2) silt loam; friable; weak, medium, platy structure; abundant tree roots; strongly acid; clear, smooth boundary.

B1—10 to 16 inches, brown (10YR 5/3) silt loam; friable; moderate, medium, subangular blocky structure; abundant tree roots; strongly acid; gradual, smooth boundary.

B21—16 to 28 inches, dark-brown to brown (7.5YR 4/4) light silty clay loam; friable; moderate, medium, subangular blocky structure; few, fine, faint, strong-brown (7.5YR 5/8) mottles, and few, fine, distinct, gray to light-gray (10YR 6/1) mottles; abundant tree roots; strongly acid; clear, smooth boundary.

IIB22—28 to 38 inches, yellowish-brown (10YR 5/4) loam; friable; moderate, coarse to medium, subangular blocky structure; occasional tree roots; strongly acid; gradual, smooth boundary.

IIIC1—38 to 62 inches, brownish-yellow (10YR 6/6) loose incoherent sand; single grain; strong-brown (7.5YR 5/6), weak iron zone at depth of 60 to 62 inches slightly higher in clay content; very strongly acid; gradual, smooth boundary.

IIIC2—62 to 72 inches +, yellow (10YR 7/6) loose incoherent sand; single grain; very strongly acid.

The A1 horizon ranges from 3 to 6 inches in thickness and is typically very dark gray (10YR 3/1), but in eroded areas it ranges to dark grayish brown (10YR 4/2). In areas that are not cultivated, the A2 horizon ranges from 4 to 8 inches in thickness and from dark gray (10YR 4/1) to grayish brown (10YR 5/2) in color. The silty overburden ranges from 24 to 40 inches in thickness and may be loess. Soils that formed in about 40 inches of silty material have a clear boundary between the silty layer and the sand layer, whereas those that developed in only 24 inches of silty material have a more gradual boundary. The B horizon developed in both the silty and sandy material, and no C horizon occurs above the sand. This sandy material may be eolian in origin. The clay content of the B horizon ranges from 26 to 32 percent.

UDOLPHO SERIES. The Udolpho series consists of somewhat poorly drained soils that developed from medium-textured material, underlain at a depth of 30 to 50 inches by fine and coarse sand. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Aquollic Normudalfs). They occur on benches along the Iowa River and its tributaries; in gently sloping, convex areas along waterways; and at the base of a sandy area near Homestead. On uplands, the parent material appears to be eolian in origin, and the soils are low in content of sand in the upper part of the solum. On terraces, the parent material appears to be alluvial, and the soils are higher in content of sand in the upper part of the solum. The native vegetation consisted of prairie grasses and trees.

These soils have a very dark gray, friable loam or silt loam A1 horizon; a weakly defined grayish-brown, friable loam or silt loam A2 horizon; a grayish-brown, mottled, friable loam to light silty clay loam B horizon; and grayish-brown, mottled sandy loam to loamy fine sand IIIC horizon that in places contains some gravel. These soils generally are leached below a depth of 50 inches. They have a moderately slowly permeable subsoil but a rapidly permeable sandy substratum.

The Udolpho soils differ from the Lawler soils in that they have a thinner, lighter colored A1 horizon and a distinct A2 horizon. They differ from the Atterberry soils in having a higher content of sand in the A and B horizons and fine and medium sand in the substratum.

Profile of Udolpho loam, 95 feet west of State Highway No. 149 and 390 feet north of railroad in the SE¼NE¼ sec. 27, T. 81 N., R. 9 W., in a nearly level meadow on a low bench.

Ap—0 to 7 inches, very dark-gray (10YR 3/1) loam; friable; clods break to weak, medium, granular structure; neutral; clear, smooth boundary.

A2—7 to 13 inches, mixed 80 percent dark grayish-brown (2.5Y 4/2) and 20 percent very dark-gray (10YR 3/1) loam; kneads to dark grayish brown (2.5Y 4/2); friable; weak, medium, platy structure; few, fine, distinct, dark-brown to brown (7.5YR 4/4) and gray (10YR 5/1) mottles; strongly acid; clear, smooth boundary.

B1—13 to 20 inches, grayish-brown (2.5Y 5/2) light loam; kneads to grayish brown (2.5Y 5/2) to light olive brown (2.5Y 5/4); friable; weak, medium, subangular blocky structure; common, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; few fine concretions of iron and manganese; medium acid; gradual, smooth boundary.

B2—20 to 34 inches, grayish-brown (2.5Y 5/2) light clay loam; kneads to dark brown to brown (10YR 4/3); friable; moderate, fine, prismatic structure breaks to weak, medium, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) and dark-brown to brown (7.5YR 4/4) mottles; common concretions of iron and manganese; medium acid; abrupt, smooth boundary.

IIC1—34 to 44 inches, grayish-brown (10YR 5/2) coarse sandy loam; kneads to dark grayish brown (10YR 4/2); friable; granular structure; few, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles, few, fine, prominent, dark-olive (5Y 3/4) mottles; some gravel, ¼ to 1 inch in diameter; strongly acid; gradual, smooth boundary.

IIIC2—44 to 49 inches +, mixed grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4), loose loamy fine sand; some gravel; few, fine, distinct, yellowish-brown (10YR 5/6), and strong-brown (7.5YR 5/6) mottles, few, fine, prominent, dark-olive (5Y 3/4) mottles.

The A1 horizon is a very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) and is from 4 to 8 inches thick. The A2 horizon is dark grayish brown (10YR 4/2) in places and is from 3 to 6 inches thick. The A horizon is silt loam or loam. The uppermost part of the B horizon has color hues of 10YR to 2.5Y, and it has values of 4 that grade to 5 and chromas of 2 that grade to 1 with depth. Few or common mottles occur in the B horizon. The B horizon is light gritty silty clay loam, light clay loam, or loam. The coarse-textured material, which occurs at a depth of 30 to 50 inches, is coarse sandy loam to loamy fine sand that contains some gravel. There is no C horizon above this coarse-textured material. The solum is medium acid or strongly acid. No carbonates occur above 50 inches.

WABASH SERIES. The Wabash series consists of very poorly drained Humic Gley soils (Cumulic Haplaquolls) that developed from fine-textured, slack-water alluvium. These soils occur in small, irregular, slightly depressed areas along the English River. They are extremely wet and are very slowly permeable. The native vegetation was marsh grasses.

The Wabash soils have a black, plastic, silty clay A horizon and a weakly developed, very dark gray, very plastic heavy silty clay B horizon that lacks oriented clay films. Mottling in the B horizon increases in abundance with depth. The reaction is slightly acid or neutral.

These soils differ from the Zook soils in having more clay in the A and B horizons. They contain more clay and have a thicker A horizon than the Bremer soils, and they have less genetic development in the B horizon. The Wabash soils differ from the Chariton soils in that they have a finer textured A1 horizon and lack an A2 horizon.

Profile of Wabash silty clay, SW. corner of the SE¼ SE¼ sec. 26, T. 78 N., R. 10 W., in a slightly depressed permanent pasture, 5 miles east and 1 mile north of North English.

A11—0 to 4 inches, black (10YR 2/1) light silty clay; slightly plastic when wet; strong, fine, subangular blocky structure; slightly acid; clear, smooth boundary.

A12—4 to 14 inches, black (N 2/0 to 10YR 2/1) medium silty clay; plastic when wet; strong, fine, subangular blocky structure; neutral; gradual, smooth boundary.

A3—14 to 24 inches, black (10YR 2/1) to very dark gray (10YR 3/1) medium silty clay; few, fine, distinct, dark-brown to brown (7.5YR 4/4) mottles; very plastic when wet; moderate, fine and medium, subangular blocky structure; neutral; gradual, smooth boundary.

B1g—24 to 39 inches, very dark gray (N 3/0) to dark gray (N 4/0) heavy silty clay; kneads to very dark gray (10YR 3/1); common, fine, distinct, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; very plastic when wet; weak, fine, prismatic structure breaks to moderate, medium, subangular and angular blocky structure; neutral; gradual, smooth boundary.

B2g—39 to 57 inches, gray (5Y 5/1) medium silty clay; kneads to dark grayish brown (2.5Y 4/2) to olive brown (2.5Y 4/4); many, medium, prominent, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) mottles; plastic when wet; moderate, medium, subangular blocky structure; common black (N 3/0) krotovinas, 1 to 2 inches in diameter; few fine concretions of black oxide; neutral; gradual, smooth boundary; 2-inch band of mixed 70 percent olive (5Y 5/6, moist) and 30 percent gray (5Y 5/1) occurs between depth of 39 and 41 inches, crushes to yellowish brown (10YR 5/4).

B3g—57 to 72 inches, mixed 70 percent dark-gray (5Y 4/1) and 30 percent olive-gray (5Y 4/2) medium silty clay; kneads to olive gray (5Y 4/2); plastic when wet;

weak, coarse, prismatic structure breaks to weak, fine and medium, subangular blocky structure; neutral.

The A1 horizon is light or medium silty clay and is black (10YR 2/1 to N 2/0) or very dark gray (10YR 3/1 to N 3/0). The A horizon is more than 20 inches thick. Colors with values of 3 or less extend to a depth of 40 inches in many places. The B horizon is distinctly gleyed, but other than this there is little or no evidence of genetic development. Clay films are lacking but shiny ped exteriors are common. The B horizon is medium or heavy silty clay and clay. The reaction is slightly acid or neutral.

WALFORD SERIES. The Walford series consists of poorly drained Planosols (Mollic Albaqualfs) that developed from loess, low in content of sand. These soils occupy flat or somewhat depressed areas on loess-covered benches. Most of the acreage in Iowa County is along the Iowa River, near Amana. These areas generally are one acre or less in size. The native vegetation consisted of prairie grasses and trees.

The Walford soils have a very dark gray, friable silt loam A1 horizon; a light brownish-gray, mottled, platy, friable silt loam A2 horizon; and a grayish-brown heavy silty clay loam B horizon. Ped coats in the upper part of the B horizon commonly are darker colored than the interior of the peds.

These soils differ from the Sperry soils in that their A2 horizon typically has colors of higher chroma, is more mottled, and contains many concretions of an oxide. They are shallower to the clay maximum than the Sperry soils, and there are less dark-colored ped coats in the upper part of the B horizon. The Walford soils differ from the Atterberry soils in having a more pronounced A2 horizon and a finer textured, firmer, more slowly permeable B horizon. They have a thinner A1 horizon and a higher chroma in the A2 horizon than the Chariton soils, and they have less distinct dark-colored coats in the upper part of the B horizon, have less clay in the B and C horizons, and are shallower to the clay maximum than the Chariton soils. They have a thinner A2 horizon and a better developed B horizon than the Coppock soils, and they are shallower to the clay maximum.

The Walford soils are the poorly drained members of the Downs, Atterberry, Walford toposequence.

Profile of Walford silt loam, 900 feet north of State Highway No. 220 and 20 feet west of field road in the SE¼SE¼ sec. 21, T. 81 N., R. 9 W., in a slightly depressed area.

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; friable; weak, medium, granular structure; few fine concretions of an oxide; neutral; abrupt, smooth boundary.

A2—8 to 15 inches, light brownish-gray (10YR 6/2) silt loam; kneads to grayish brown (10YR 5/2); very friable; weak, medium, platy structure; common, fine, distinct, dark-brown (7.5YR 4/4) mottles; many fine and medium concretions of black oxide; few, fine, dark-colored tubular pores; slightly acid; clear, smooth boundary.

B21—15 to 21 inches, grayish-brown (10YR 5/2) medium silty clay loam; kneads to dark brown (10YR 4/3); friable; moderate, medium, subangular blocky structure; common, fine, distinct, brown (7.5YR 4/4) mottles; gray (10YR 6/1) silt grains on peds when dry; thin continuous clay films; few, fine, black-coated root channels; medium acid; clear, smooth boundary.

B22—21 to 37 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam; kneads to dark brown (10YR 4/3); firm; weak, medium, prismatic structure breaks to moderate, medium, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; thin continuous clay films; few black-coated root channels; few fine concretions of black oxide; many fine tubular pores; medium acid; gradual, smooth boundary.

B3—37 to 47 inches, mixed light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/6) light to medium silty clay loam; kneads to grayish brown (2.5Y 5/2); friable to firm; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few fine concretions of black oxide; many, fine, dark-colored tubular pores; common, fine, black-coated root channels; neutral; gradual, smooth boundary.

C—47 to 60 inches, mixed light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/6) heavy silt loam; kneads to grayish brown (2.5Y 5/2); friable; massive with vertical cleavage; neutral.

The A1 horizon ranges from 6 to 10 inches in thickness and from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) in color in some cultivated areas. The A2 horizon ranges from 4 to 8 inches in thickness and from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2) in color. The A2 horizon contains common or many mottles and concretions of an oxide. Silt coats are evident in the upper part of the B horizon. The B horizon is medium silty clay loam but in places ranges to heavy silty clay loam. It is grayish brown (10YR 5/2) to light brownish gray (2.5Y 6/2). Coats that have a value of 4 and a chroma of 1 generally are evident in the upper part of this horizon. The solum commonly is medium acid in the most acid part but ranges to strongly acid in places. Carbonates are lacking above 60 inches.

WATKINS SERIES. The Watkins series consists of well-drained Gray-Brown Podzolic soils that are intergrading toward Brunizems (Mollic Normudalfs). These soils formed from medium-textured or moderately fine textured alluvium. They occur on nearly level and gently sloping terraces along the major streams. The native vegetation was prairie grasses and trees.

These soils have a very dark gray, friable silt loam A1 horizon; a grayish-brown, weakly defined A2 horizon; and a very dark grayish-brown to brown, friable or firm silty clay loam B horizon that is free of mottles in the upper part. They generally are medium acid throughout.

The Watkins soils occupy positions similar to those occupied by the Wiota soils, but they have a lighter colored, thinner A1 horizon and an incipient A2 horizon. They differ from the Downs soils that occur on uplands in that they contain a higher content of sand, and there commonly are stratified layers of loam, silt loam, and silty clay loam in the C horizon. The Watkins soils differ from the Koszta soils in that they have colors of higher chroma in the B horizon and are less mottled. They have a thicker A1 horizon and a less distinct A2 horizon than the Bertrand soils, and the clay ratio of the B and C horizons is lower. The Watkins soils have darker colored coats in the upper part of the B horizon than the Bertrand soils. They have a less distinct A2 horizon and a higher chroma in the B horizon than the Jackson soils, and the clay ratio of the B and C horizons is lower.

The Watkins soils are considered to be the prairie-forest members of the biosequence that includes the prairie-formed Wiota soils, and they are the well-drained mem-

bers of the toposequence that includes the somewhat poorly drained Koszta soils.

Profile of Watkins silt loam, 309 feet west and 200 feet south of the NE. corner of the NE¼NW¼ sec. 33, T. 81 N., R. 10 W., in a gently sloping alfalfa-brome pasture, 3 miles east of Marengo.

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; friable; weak, thick, platy structure breaks to weak, fine, granular structure; few, fine, faint, dark yellowish-brown (10YR 4/4) peds; medium acid; clear, smooth boundary.

A2—7 to 12 inches, very dark grayish-brown (10YR 3/2) to dark grayish-brown (10YR 4/2) silt loam; 10 percent is dark yellowish brown (10YR 4/4); friable; weak, thick, platy structure breaks to weak, fine, subangular blocky structure; light-gray (10YR 7/1) silt grains on peds when dry; medium acid; gradual, smooth boundary.

B1—12 to 18 inches, dark grayish-brown (10YR 4/2) heavy silt loam; 15 percent is dark yellowish brown (10YR 4/4); kneads to dark grayish brown (10YR 4/2); friable; moderate, fine, subangular blocky structure; light-gray (10YR 7/1) silt grains on peds when dry; few concretions of black oxide; medium acid; gradual, smooth boundary.

B21—18 to 29 inches, dark-brown to brown (10YR 4/3) light to medium silty clay loam; friable to firm; weak, fine, prismatic structure breaks to moderate, medium, subangular and angular blocky structure; few light-gray (10YR 7/1) silt grains on peds when dry; thin discontinuous clay films; slightly acid; gradual, smooth boundary.

B22—29 to 35 inches, dark-brown to brown (10YR 4/3) medium silty clay loam; friable to firm; weak, coarse, prismatic structure breaks to moderate, coarse, subangular and angular blocky structure; few, fine, faint, yellowish-brown (10YR 5/6) mottles; thin discontinuous clay films; few very dark-brown oxide stains; slightly acid; gradual, smooth boundary.

B3—35 to 52 inches, dark-brown to brown (10YR 4/3) light silty clay loam; friable to firm; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; thin discontinuous clay films; light-gray (10YR 7/1) silt grains on peds when dry; medium acid; gradual, smooth boundary.

C—52 to 65 inches, brown (10YR 5/3), light silty clay loam; friable to firm; massive; thin streaks of gray (5Y 6/1) throughout matrix; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few very fine concretions of black oxide; medium acid.

The A1 horizon is very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) and is from 4 to 8 inches thick. The A2 horizon is from 3 to 6 inches thick and ranges from distinct to incipient. It ranges from very dark grayish brown (10YR 3/2) to grayish brown (10YR 5/2). Concretions of an oxide are common in the A2 horizon. The B horizon ranges from heavy silt loam to medium silty clay loam. It has color hues of 10YR, a value of 4 that grades to 5 with depth, and a chroma of 3. A chroma of 2 occurs in the upper part of the B horizon, but no mottling is evident. The clay ratio of the B and C horizons is low, and the consistence of the B3 and C horizons commonly is friable or firm. The solum is medium or slightly acid. Weak stratification within the C horizon is common, and coarse-textured material occurs below a depth of 48 inches in some places.

Waubeek Series. The Waubeek series consists of well drained or moderately well drained Gray-Brown Podzolic soils that are intergrading toward Brunizems (Mollic Normudalfs). These soils developed from thin loess that is from 20 to 40 inches thick over loam glacial till. They occur on gentle convex slopes, on uplands of the loess-mantled Iowan till plain. The slope ranges from 2 to 9 percent. The A horizon and the upper part of the B horizon developed from loess, and the lower part of the B horizon and the C horizon from friable or firm loam till. In some places a zone of sandy sediments, a few inches thick, occurs immediately above the till. The native vegetation was prairie grasses and trees.

The A1 horizon of the Waubeek soils is very dark-gray, friable silt loam; the upper part of the B horizon is dark-brown, friable silty clay loam; and the lower part of the B horizon and the C horizon are grayish-brown to yellowish-brown, friable to firm loam to clay loam.

These soils differ from the Dinsdale soils in having a lighter colored, thinner A1 horizon; a weakly developed A2 horizon; and evident silt coats in the B horizon. They developed from two-storied material consisting of loess and glacial till, whereas the Gara soils were derived from till, and the Downs soils from loess.

The Waubeek soils are the prairie-forest members of the biosequence that includes the prairie-formed Dinsdale soils.

Profile of Waubeek silt loam, 364 feet south and 84 feet west of the center of the SE¼ sec. 12, T. 81 N., R. 9 W., on a 3 percent convex slope, in an alfalfa-brome meadow.

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; 10 percent is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2), when dry; friable; clods break to weak, thin, platy structure; few grayish-brown (10YR 5/2) grainy coats; neutral; abrupt, smooth boundary.

B1—7 to 13 inches, dark-brown to brown (10YR 4/3) heavy silt loam; friable; weak, fine, subangular blocky structure; few very dark grayish-brown (10YR 3/2) worm casts; few gray to light-gray (10YR 6/1) grainy coats; neutral; gradual, smooth boundary.

B21—13 to 19 inches, light silty clay loam; dark grayish brown (10YR 4/2) on exterior of peds, and dark brown to brown (10YR 4/3) on interior of peds; kneads to brown (10YR 5/3); friable; moderate, fine, subangular blocky structure; thin discontinuous clay films; few very fine concretions of black oxide; medium acid; few gray to light gray (10YR 6/1) grainy coats; clear, smooth boundary.

B22—19 to 29 inches, medium silty clay loam; grayish brown (10YR 5/2) on exterior of peds, and brown (10YR 5/3) on interior of peds; friable; sand content increases with depth; moderate, fine, angular and subangular blocky structure; few, fine, faint mottles of gray (10YR 5/1), yellowish brown (10YR 5/8), and dark brown to brown (7.5YR 4/4); gray (10YR 6/1) silt grains on peds when dry; thin discontinuous clay films; common fine concretions of black oxide; medium acid; clear, smooth boundary.

IIB23—29 to 34 inches, mixed grayish-brown (10YR 5/2) and strong-brown (7.5YR 5/6) loam; kneads to yellowish brown (10YR 5/4); friable to firm; moderate, medium, subangular and angular blocky structure; light brownish-gray (10YR 6/2) silt grains on peds when dry; common fine concretions of black oxide; strongly acid; gradual, smooth boundary.

IIB3—34 to 45 inches, loam; grayish brown (10YR 5/2) on exterior of peds and strong brown (7.5YR 5/6) on interior of peds; kneads to yellowish brown (10YR 5/4); friable to firm; weak, coarse, prismatic structure breaks to coarse, subangular and angular blocky structure; common, fine, faint, grayish-brown (10YR 5/2) mottles, and few, fine, prominent, yellowish-red (5YR 4/6) mottles; common fine concretions and stains of black oxide; strongly acid; gradual, smooth boundary.

IIB32—45 to 57 inches, yellowish-brown (10YR 5/4) loam; friable to firm; massive with vertical cleavage; few, fine, faint, strong-brown (7.5YR 5/6) mottles; and common, thin, grayish-brown (10YR 5/2) streaks; few fine root channels filled with dark-gray clay; few

black oxide stains; medium acid; gradual, smooth boundary.

IIC—57 to 67 inches, yellowish-brown (10YR 5/4) loam; friable to firm; massive with vertical cleavage; few, fine, faint, strong-brown (7.5YR 5/6) mottles, and common, thin, grayish-brown (10YR 5/2) streaks; few black oxide stains; neutral; clear, wavy boundary.

IIC2—67 to 75 inches, yellowish-brown (10YR 5/4) loam; friable; massive; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few, thin, grayish-brown (10YR 5/2) streaks; few fine concretions of lime; moderately alkaline.

The A1 horizon is very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) and is from 4 to 6 inches thick. The A2 horizon is weakly defined and is from 2 to 4 inches thick. In cultivated areas, it commonly is part of the Ap horizon. If the A2 horizon is lacking, the boundary from the Ap horizon to the B horizon is abrupt and very distinct. The B horizon has color values of 4 and 5 and chromas of 3 and 4. Some coats with a chroma of 2 commonly occur in the upper part of the B horizon. Silt coats and clay films are distinctly evident in the B horizon. In places there are a few, fine, gray to strong-brown mottles in the lower part of the B horizon. The loess ranges from 20 to 40 inches in thickness and from 5 to 20 percent in content of sand. The B horizon developed from loess and glacial till, and the clay maximum is less than 35 percent. The IIB horizons range from loam to clay loam. In places less than 6 inches of sandy sediments or pebbles occur between the loess and the glacial till. The solum is mainly medium acid, and carbonates commonly are leached below a depth of 45 inches.

WAUKEGAN SERIES. The Waukegan series consists of well-drained or somewhat excessively drained, medium-textured Brunizems (Typic Hapludolls). These soils occur on high or intermediate stream terraces along the Iowa River and along some tributaries of the Iowa River; on uplands adjoining terraces that are near or in the Amana Colonies; and on uplands near Price Creek in Lenox and Washington Townships. The native vegetation was prairie grasses.

The Waukegan soils have a very dark brown, friable loam A horizon; a dark brown, friable light silty clay loam to loam B horizon; and a loose, yellowish-brown medium and fine sand IIC horizon.

These soils differ from the Wiota soils in that they have a higher content of sand in the A and B horizons and a sandy IIC horizon at a depth of 20 to 40 inches. They differ from the Dickinson soils in having medium-textured A and B horizons.

Profile of Waukegan loam, 620 feet east and 650 feet north of center of sec. 5, T. 80 N., R. 9 W., in a nearly level cultivated field, 150 feet south of center of U.S. Highway No. 6.

A1—0 to 10 inches, very dark brown (10YR 2/2) loam to gritty silt loam; friable; noticeable sand grains; weak, fine, granular structure; neutral; clear, smooth boundary.

AB—10 to 16 inches, dark-brown (10YR 3/3) silt loam; friable; noticeable sand grains; weak, fine, subangular blocky structure; slightly acid; gradual, smooth boundary.

B2—16 to 27 inches, dark-brown to brown (10YR 4/3) light silty clay loam; friable; noticeable sand grains; weak, fine and medium, subangular blocky structure; medium acid; gradual, smooth boundary.

B3—27 to 33 inches, dark-brown to brown (10YR 4/3) loam; very friable; massive, with some vertical cleavage; medium acid; clear, smooth boundary.

IIC1—33 to 41 inches, yellowish-brown (10YR 5/4) fine and medium sand; loose; incoherent; single grain; medium acid; gradual, smooth boundary.

IIC2—41 to 60 inches, light yellowish-brown (10YR 6/4) sand; loose; incoherent; single grain; medium acid; band of loose, dark yellowish-brown (10YR 4/4) loamy sand and iron, 1½ inches thick, at depth of 52 inches.

Profile of Waukegan loam, 950 feet west and 210 feet north of the center of sec. 4, T. 80 N., R. 9 W., on a 7 percent convex slope in a cultivated field, 90 feet south of U.S. Highway No. 6.

Ap—0 to 8 inches, very dark brown (10YR 2/2) and some dark-brown (10YR 4/3) loam to gritty silt loam; kneads to very dark grayish brown (10YR 3/2); friable; many noticeable fine sand grains; weak, fine, granular structure; neutral; clear, smooth boundary.

AB—8 to 15 inches, dark-brown (10YR 3/3) and some brown (10YR 4/3) silt loam; kneads to dark brown (10YR 3/3); friable; noticeable sand content; weak, fine, subangular blocky structure; medium acid; gradual, smooth boundary.

B2—15 to 26 inches, dark-brown to brown (10YR 4/3) light silty clay loam; friable; noticeable sand content; weak, medium, subangular blocky structure; medium acid; clear, smooth boundary.

IIC1—26 to 35 inches, yellowish-brown (10YR 5/4) fine and medium sand; loose; incoherent; single grain; medium acid; gradual, smooth boundary.

IIC2—35 to 58 inches, light yellowish-brown (10YR 6/4) fine and medium sand; loose; incoherent; single grain; medium acid.

Irregular, ¼- to 1-inch, wavy bands of dark-brown (7.5YR 4/4) loose loamy sand, at depths of 33, 40, 44, and 54 inches.

Profile of Waukegan silt loam, 400 feet east and 115 feet south of the NW. corner of the NW¼NW¼ sec. 1, T. 80 N., R. 10 W., on a 3 percent convex slope in a cultivated field.

Ap—0 to 7 inches, black (10YR 2/1) heavy silt loam; kneads to very dark brown (10YR 2/2); friable; moderate, medium, granular structure; neutral; clear, smooth boundary.

A12—7 to 12 inches, very dark brown (10YR 2/2) light silty clay loam; friable; weak, fine, subangular blocky structure breaks to moderate, medium, granular structure; neutral; clear, smooth boundary.

A3—12 to 15 inches, mixed very dark grayish-brown (10YR 3/2) and dark-brown (10YR 3/3) light silty clay loam; friable; weak, fine, subangular blocky structure; slightly acid; gradual, smooth boundary.

B1—15 to 20 inches, dark-brown (10YR 3/3) medium silty clay loam; friable; thin discontinuous clay films; weak, medium, subangular blocky structure; strongly acid; gradual, smooth boundary.

B2—20 to 27 inches, dark-brown to brown (10YR 4/3) medium silty clay loam; friable; thin, discontinuous, clay films; weak, fine, subangular blocky structure; strongly acid; gradual, smooth boundary.

B3—27 to 34 inches, dark-brown to brown (10YR 4/3) light silty clay loam; kneads to brown (10YR 5/3); friable; weak, medium, subangular blocky structure; strongly acid; abrupt, smooth boundary.

IIC1—34 to 40 inches, dark yellowish-brown (10YR 4/4) loamy fine sand; loose; single grain; strongly acid; gradual, smooth boundary.

IIC2—40 to 47 inches, yellowish-brown (10YR 5/4) fine sand; loose; single grain; strongly acid; abrupt, smooth boundary.

IIB—47 to 48 inches, dark-brown (7.5YR 4/4) loamy fine sand; (iron band); very friable; single grain; strongly acid; abrupt, smooth boundary.

IIC3—48 to 55 inches, light yellowish-brown (10YR 6/4) fine sand; loose; single grain; ½- to 1-inch, irregular, wavy, dark-brown iron band; medium acid.

The A1 horizon is very dark gray (10YR 3/1) to very dark brown (10YR 2/2) and is from 8 to 16 inches thick. The A horizon is loam to silt loam. The B horizon has color values of 3 and higher and chromas of 3 and higher. There are no mottles in the B horizon, and the texture is light silty clay loam but ranges to medium silty clay loam in places. Leached coarse-textured material occurs between a depth of 20 and 40 inches in Waukegan loam and between a depth of 24 and 45 inches in Waukegan silt loam. The solum typically is medium acid but may be less acid at or near the surface.

WIOTA SERIES. The Wiota series consists of well drained or moderately well drained soils that developed from medium-textured alluvium on stream terraces throughout the county. These soils are classified as Brunizems (Typic Hapludolls). The slope ranges from 0 to 5 percent. The native vegetation was prairie grasses. Figure 4, page 4, shows the relationship of these soils to associated soils.

The Wiota soils have a very dark brown, friable silt loam A1 horizon; a dark-brown to brown silty clay loam B horizon; and a dark yellowish-brown, mottled loam to silty clay loam C horizon. The clay ratio of the B and C horizons is low. The solum typically is medium acid.

These soils occupy positions similar to those of the Watkins soils, but they differ from those soils in that they have a thicker A1 horizon, lack an A2 horizon, and lack distinct silt coats in the B horizon. They differ from the Nevin soils in that they have browner colors in the A and B horizons and are less mottled. They have a higher content of sand in the A and B horizons than the Tama soils on uplands, and they commonly are stratified in the B3 horizon or in the C horizon.

The Wiota soils are the well-drained members of the toposequence that includes the somewhat poorly drained Nevin soils and the poorly drained Bremer soils.

Profile of Wiota silt loam, in the NE¼SE¼ sec. 9, T. 79 N., R. 10 W., on a 3 percent convex slope, in a meadow, ¼ mile north of Williamsburg.

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; dark grayish brown (10YR 4/2) when dry; friable; clods break to weak, fine, granular structure; slightly acid; clear, smooth boundary.

A12—8 to 16 inches, very dark brown (10YR 2/2) silt loam; friable; moderate, very fine, subangular blocky structure; medium acid; gradual, smooth boundary.

A3—16 to 25 inches, mixed very dark brown (10YR 2/2) and dark brown (10YR 3/3) light silty clay loam; kneads to very dark grayish brown (10YR 3/2); friable; moderate, fine and very fine, subangular blocky structure; medium acid; clear, smooth boundary.

B2—25 to 35 inches, mixed dark-brown to brown (10YR 4/3) and very dark grayish-brown (10YR 3/2) light or medium silty clay loam; kneads to brown (10YR 5/3); some dark grayish-brown (10YR 4/2) ped coats; friable; moderate, fine, subangular blocky structure; medium acid; gradual, smooth boundary.

B3—35 to 45 inches, brown (10YR 5/3) light silty clay loam; pale brown (10YR 6/3) when dry; friable; weak, medium and coarse, subangular blocky structure; few, fine, faint, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/8) mottles, and few, fine, distinct, grayish-brown (2.5Y 5/2) mottles; medium acid; gradual, smooth boundary.

IIc—45 to 55 inches, dark yellowish-brown (10YR 4/4) loam; friable; massive with some vertical cleavage; common, fine, faint, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/8) mottles; slightly acid.

The A1 horizon is black (10YR 2/1) to very dark brown (10YR 2/2) and is from 14 to 18 inches thick. The A horizons commonly have color values of 3 or lower to a depth of 24 inches. The B horizon ranges from heavy silt loam to medium silty clay loam. In places some yellowish-brown, strong-brown, or grayish-brown mottles are evident in the B3 and C horizons. The C horizon is silty clay loam to loam. Coarse-textured strata may occur below a depth of 48 inches. The solum typically is medium acid but ranges to slightly acid in some places.

ZOOK SERIES. The Zook series consists of poorly drained soils that formed from slack-water sediments. These soils have weak horizonation and are very slowly permeable. They are classified as Humic Gley (Wiesenboden) soils that are intergrading toward Alluvial soils (Cumulic Haplaquolls). They occur in level or slightly depressed areas along the Iowa and English Rivers. The native vegetation was mainly marsh and prairie grasses.

The Zook soils have a black to very dark gray, firm medium to heavy silty clay loam A1 horizon and a very dark gray light silty clay B horizon that grades to dark gray and gray with depth. Oriented clay films are not evident in the B horizon.

These soils have a finer textured B horizon than the Colo soils. They differ from the Bremer soils in that they have color values of 3 or less to a depth of 30 inches or more, lack distinct horizonation, have no clay films in the B horizon, and have less evident mottles. The Zook soils have a silty clay loam A horizon and a light silty clay B horizon, whereas the Wabash soils have a medium silty clay B horizon.

Profile of Zook silty clay loam, 1,050 feet north and 50 feet west of the center of sec. 31, T. 78 N., R. 9 W., in a level cultivated field.

Ap—0 to 7 inches, black (10YR 2/1) to very dark gray (10YR 3/1) heavy silty clay loam; firm; cloddy; neutral; clear, smooth boundary.

A12—7 to 19 inches, black (10YR 2/1) heavy silty clay loam to light silty clay; firm; moderate, very fine, subangular blocky structure; slightly acid; gradual, smooth boundary.

B1—19 to 31 inches, very dark gray (10YR 3/1) to dark gray (5Y 4/1) light silty clay; very firm; weak, very fine, prismatic structure breaks to weak, fine, subangular blocky structure; few, fine, distinct, yellowish-brown mottles; medium acid; gradual, smooth boundary.

B2g—31 to 45 inches, dark-gray (5Y 4/1) light silty clay; firm; moderate, medium, prismatic structure; common, fine, distinct, yellowish-brown (10YR 5/4) mottles; medium acid; gradual, smooth boundary.

Cg—45 to 50 inches, gray (5Y 5/1) heavy silty clay loam; kneads to olive brown (2.5Y 4/4); firm; massive; many, fine, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/8) mottles; slightly acid.

The A1 horizon ranges from light to heavy silty clay loam in texture, from black (N 2/0 to 10YR 2/1) to very dark gray (10YR 3/1) in color, and from 18 to 40 inches in thickness. The B horizon is weakly defined and ranges from heavy silty clay loam to light silty clay. It grades from 3 to 5 in color value with depth and has a chroma of 1. The maximum clay content ranges from about 38 percent to 48 percent. Mottling is evident but indistinct in the upper part of the B horizon. The C horizon ranges from heavy silty clay loam to light silty clay. The solum is slightly or medium acid. Horizon boundaries are gradual or diffuse.

General Nature of the Area

This section was prepared mainly for those not familiar with the county. It discusses the vegetation, topography, drainage, and climate of the county.

Vegetation

The native vegetation of Iowa County consists mainly of prairie grasses and of oak-hickory type forest. At one time prairie grasses covered much of the nearly level to rolling uplands, especially in the central part of the county between Conroy and Parnell. Oak-hickory type forest generally occupied the steeper areas near and along streams. In some areas the trees formed large wooded tracts across the upland divides. From the nature and distribution of soil types, it appears that the forest invaded the grasslands along the major stream valleys and then gradually spread out from the valleys to the uplands.

Few areas now remain in native vegetation or in vegetation that has not been changed in some way. Bluestem, a tall native prairie grass, has been practically eliminated by grazing and cultivation. Some scattered patches occur along the right-of-way of railroads or on banks of unimproved county roads. In places the bluestem has been replaced by bluegrass.

Most of the native timber has been cut over. The largest areas of timber are north and south of the Iowa River in the Amana Colonies. Selective cutting has been practiced throughout these areas.

Topography

Iowa County is a gently rolling to steep upland plain, deeply dissected in places by rivers and streams. The area immediately north of the Iowa River is characterized by an intricate pattern of deep valleys and ravines that have steep slopes. Small streams extend back into the uplands.

The bottom lands along the Iowa River are nearly level; the terraces away from the river are nearly level to undulating.

Hills on either side of the flood plain rise from 100 to 200 feet above the river. In places these hills are from 50 to 100 feet above the level of the plain into which they merge.

The northern corner of Lenox Township, for the most part, has level or gently undulating topography that is characteristic of what has been called the Iowan drift plain.

In a broad curve from east to west across the central part of the county is a more nearly level plain, 4 or 5 miles wide, called the divide. This plain, which represents the greatest part of the original prairie land of the county, separates the Iowa and English Rivers. The English River, its tributaries, and many small intermittent streams have cut steep valleys along this entire area. The slope in this area increases in steepness toward the stream channels.

Drainage

Streams and intermittent drainageways have dissected practically all parts of the county. The Iowa River extends from west to east through the northern part. Honey Creek, Big Bear Creek, and Little Bear Creek are the main tributaries flowing into the Iowa River from the south. Price Creek, which flows almost at right angles into the Iowa River, is the main tributary from the north. From Conroy eastward, the area is drained by Clear Creek. Hog Run joins Old Mans Creek west of Williamsburg to drain the area east of Williamsburg and Parnell. The southern

TABLE 8.—*Summary of temperature and precipitation*

[Based on a 30-year record,

Month	Temperature in °F.							Mean heating degree-days [1]
	Mean			Extreme				
				Record highest		Record lowest		
	Daily maximum	Daily minimum	Monthly	Degrees	Year	Degrees	Year	
January	31.1	12.5	21.8	61	1944	−26	1957	1,339
February	34.8	15.9	25.4	67	1932	−25	1933	1,119
March	45.8	25.4	35.6	87	1938	−18	1960	911
April	61.7	38.1	49.9	90	1952	10	1936	453
May	72.6	49.5	61.1	109	1934	26	1931	198
June	82.0	59.7	70.8	108	1934	37	1956	48
July	87.2	63.7	75.5	110	1940 [3]	47	1959 [3]	6
August	84.7	61.7	73.2	111	1934	40	1958 [3]	19
September	77.4	52.8	65.1	103	1933	25	1942	111
October	66.5	41.7	54.1	96	1938	10	1952	388
November	48.2	27.8	38.0	81	1933	−7	1959	810
December	35.6	18.0	26.8	66	1951 [3]	−20	1951	1,184
Year	60.6	38.9	49.8	111	1934	−26	1957	6,586

[1] Degree-days based on 65° F. The heating degree-days for a day are determined by subtracting the average daily temperature from 65. These daily values are totaled to obtain the number of degree-days in a month. For example, to determine the mean degree-days for January in an 8-year period, total the degree-days for each January in that period and divide by eight.

part of the county is drained by the English River and its tributaries.

The drainage system is well developed and is adequate in most parts of the county. However, artificial drainage is needed in some depressed areas on uplands and on bottom lands that are above ordinary overflow but that receive runoff from surrounding steep uplands.

Climate [10]

The climate in Iowa County is typically continental, with frequent and often rapid changes in weather throughout the year. The summers are warm and the winters cold, but prolonged periods of extreme heat or intense cold are comparatively rare. Two major storm tracks, one from the northwest and the other from the southwest, account for most of the pronounced and sometimes violent changes in weather.

Though changes in weather are frequent, the climate of the county as a whole does not vary greatly. The climate at Williamsburg is representative of the county and is summarized in table 8.

On calm, clear nights, the minimum temperature in valleys and other lowlands may be a few degrees lower than that at higher elevations. Showers, which occur primarily during the warmest half of the year, vary considerably in amount and intensity within comparatively short distances, but the seasonal rainfall over the county does not vary greatly.

Summer rainfall consists mostly of thunderstorms and sudden showers, which are sometimes accompanied by high winds and hail. Hail occurs most frequently in June and in 2 years out of 5 will damage more than 50,000 acres of cropland. A tornado can be expected almost every year in Iowa County.

The largest amount of rainfall recorded in a day at Williamsburg was on June 15, 1930, when 6.02 inches fell. However, a 3-inch rainfall in 24 hours and 1.45-inch in 1 hour can be expected about once every other year.

Normally, about two-thirds of the annual precipitation falls during the growing season, or from April through September. The seasonal peak occurs in June. The chance of an inch or more of rainfall per week (about the requirement of growing corn) is about 4 in 10 during June, and about 3 in 10 during July and August. The driest period in summer is the last two or three weeks of August. Beginning August 16, the probability of two consecutive rainless weeks is about once in 13 years, and the probability of three rainless weeks is about once in 25 years.

The English River overflows about four or five times a year, and the Iowa River about three or four times a season, generally between March and July.

The average seasonal snowfall is 24.8 inches. The average date of the first measurable snowfall is November 24, and that of the first snowfall of an inch or more is December 1.

Temperature extremes recorded ranged from 111° F. on August 8, 1934 to −26° F. on January 14, 1957. On an average of 15 days a year, the temperature falls to zero or lower, and on an average of 31 days a year it reaches 90° or higher, which is too hot for the best growth of most plants. The average period without freezing temperature ranges from 155 to 160 days from north to south across Iowa County. Probabilities of the last freezing temperature in spring and the first in fall are given in table 9.

[10] This section was prepared by PAUL J. WAITE, State climatologist, U.S. Weather Bureau.

at Williamsburg Station, Iowa County, Iowa

from 1931 through 1960]

Precipitation in inches								Mean number of days with—				
Mean	Greatest daily		Snow and sleet					Precipitation of 0.10 inch or more	Maximum temperature of—		Minimum temperature of—	
	Inches	Year	Mean	Greatest monthly		Greatest daily			90° and above	32° and below	32° and below	0° and below
				Inches	Year	Inches	Year					
1. 25	1. 68	1960	6. 4	14. 9	1936	9. 0	1931	3	0	15	30	7
. 98	1. 35	1948	5. 0	18. 0	1960	10. 0	1960	3	0	11	27	4
1. 96	2. 86	1945	6. 2	27. 0	1959	12. 0	1931	5	0	5	24	1
2. 61	2. 46	1959	. 5	4. 2	1936	4. 0	1959	6	0	0	10	0
3. 71	2. 50	1951	(2)	. 3	1935	. 3	1935	7	1	0	1	0
4. 75	4. 27	1950	0	0	--------	0	--------	7	6	0	0	0
3. 56	3. 60	1948	0	0	--------	0	--------	5	11	0	0	0
3. 16	3. 15	1951	0	0	--------	0	--------	5	9	0	0	0
3. 10	3. 12	1958	(2)	. 2	1942	. 2	1942	5	4	0	0	0
2. 30	2. 10	1949	(2)	(2)	1957 [3]	(2)	1957 [3]	4	0	0	5	0
2. 07	3. 00	1952	2. 1	11. 5	1934	11. 0	1934	4	0	3	20	0
1. 25	1. 47	1952	4. 5	21. 8	1951	5. 0	1943 [3]	3	0	11	29	3
30. 70	4. 27	1950	24. 8	27. 0	1959	12. 0	1931	57	31	45	146	15

[2] Trace.
[3] Also on earlier dates, months, or years.

TABLE 9.—*Probabilities of last freezing temperature in spring and first freezing temperature in fall*

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	Mar. 31	Apr. 10	Apr. 19	May 1	May 13
2 years in 10 later than	Mar. 26	Apr. 4	Apr. 13	Apr. 26	May 8
5 years in 10 later than	Mar. 17	Mar. 24	Apr. 2	Apr. 17	Apr. 28
Fall:					
1 year in 10 earlier than	Nov. 6	Oct. 29	Oct. 14	Oct. 5	Sept. 23
2 years in 10 earlier than	Nov. 11	Nov. 3	Oct. 19	Oct. 11	Sept. 29
5 years in 10 earlier than	Nov. 20	Nov. 11	Oct. 30	Oct. 21	Oct. 11

Agriculture

Although the trend in recent years has been toward a decrease in the number of farms in the county, the size of the individual farms generally has increased. Livestock farms far outnumber all other types of farms, and most of the crops harvested are consumed by livestock on the farm where the crops are grown.

Farm tenure

According to the report of the tax assessor, full owners operated 60.3 percent of the farms in Iowa County in 1959 and tenants operated 39.7 percent. The percentage of owner-operator farms is higher in Iowa County than the State average, which was 50.8 percent in 1959. Most tenants are livestock-share tenants, but there are some cash tenants.

Land use

The U.S. Census of Agriculture for 1959 shows that the total land in farms in Iowa County amounted to 356,426 acres. There were 1,774 farms in the county in 1959, and the average size was 200.9 acres. At that time, cropland harvested made up 221,597 acres; pasture, not cropland or woodland, made up 17,623 acres; and woodland, 4,878 acres.

Crops

Except for soybeans, most field crops grown in Iowa County are fed to livestock. Some corn is sold as a cash crop, but the amount sold varies from year to year and depends largely on the price of feeder cattle, the market for fat cattle, the market for hogs, the cash price for corn, and the quality of the corn crop. Although corn is the principal grain crop, the acreage in soybeans has increased appreciably since 1940. The acreage in oats has also increased, but the acreage in wheat, barley, and rye has decreased. Following is the acreage in various grain crops in Iowa County in 1959:

	Acres
Corn for all purposes	121, 074
Oats	42, 497
Soybeans for beans	8, 443
Wheat	227
Sorghums for all purposes	128
Barley	85
Rye	63

Livestock

Beef cattle, hogs, dairy cattle, and poultry are the livestock most extensively raised in Iowa County. According to the figures obtained from local sources, the principal kinds of livestock raised in the county and sold in 1959 were as follows:

Grain-fed cattle sold	39, 704
Grain-fed sheep and lambs sold	15, 204
Calves born	21, 804
Lambs born	7, 145
Sows farrowing, fall	15, 719
Sows farrowing, spring 1960	21, 017
Milk cows, 2 years old and older	7, 641
Beef cows, 2 years old and older	16, 229
Chickens	170, 411
Turkeys	172, 992

Marketing

Beef and hogs are the most important livestock products to be marketed. A large meatpacking plant, located in Cedar Rapids, provides the closest market for these products. However, the highways and railroads connect with cities that provide markets for livestock products.

Most milk produced in the county is processed and marketed through cooperative creameries at North English, Williamsburg, or Marengo. Some is marketed through dairies in Cedar Rapids. Most of the milk is picked up and delivered to market by truckers who are under contract to dairies or to groups of farmers. The many improved roads in the county are an aid in the delivery of milk to market each day. Local grain elevators provide a market for grain crops.

Transportation

State and interstate highways through the county provide routes for auto traffic and for the transportation of farm products to markets in other parts of the country. Interstate Highway 80 crosses just north of the center of the county; U.S. Highway 6 and State Highway 212 serve Marengo, the county seat; and State Highway 149 serves Williamsburg. The many graveled and asphalt county roads enable farmers to come to the trading centers throughout the year.

Railroads cross the northern and mideastern parts of Iowa County, and a spur line connects Cedar Rapids with Ottumwa, Iowa. Scheduled airline flights serve Cedar Rapids and Iowa City; bus transportation is avail-

able in most parts of the county; and motor freight lines serve every trading center in the county.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Bench position. A high, shelflike position.

Biosequence. A sequence of soils whose properties are functionally related to differences in organisms as a soil forming factor.

Bottom land. The normal flood plain of a stream and the old alluvial plain that is seldom flooded. (See Bottoms, first, and Bottoms, second.)

Bottoms, first. The normal flood plain of a stream; land along the stream subject to overflow.

Bottoms, second. An old alluvial plain, usually flat or smooth, that borders a stream but is seldom flooded.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour tillage. Cultivation that follows the contour of the land, generally almost at right angles to the slope.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Friable. (See Consistence.)

Hydrosequence. A sequence of soils whose properties are functionally related to differences in drainage and moisture content as a soil-forming factor.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major soil horizons:

A horizon.—The mineral horizon at the surface. It has an accumulation of organic matter, has been leached of soluble minerals and clay, or shows the effects of both.

B horizon.—The horizon in which clay minerals or other material has accumulated, that has developed a characteristic blocky or prismatic structure, or that shows the effects of both processes.

C horizon.—The unconsolidated material immediately under the true soil. In chemical, physical, and mineral composition it is presumed to be similar to the material from which at least part of the overlying solum has developed.

Leaching, soil. The removal of materials in solution by the passage of water through soil.

Parent material. The weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Reaction. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Sand. As a soil separate, individual rock or mineral fragments ranging from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but they may be any mineral composition. As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Solum, soil. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties, unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil; the C horizon.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (structural). An embankment or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Toposequence. A sequence of soils whose properties are functionally related to topography as a soil-forming factor.

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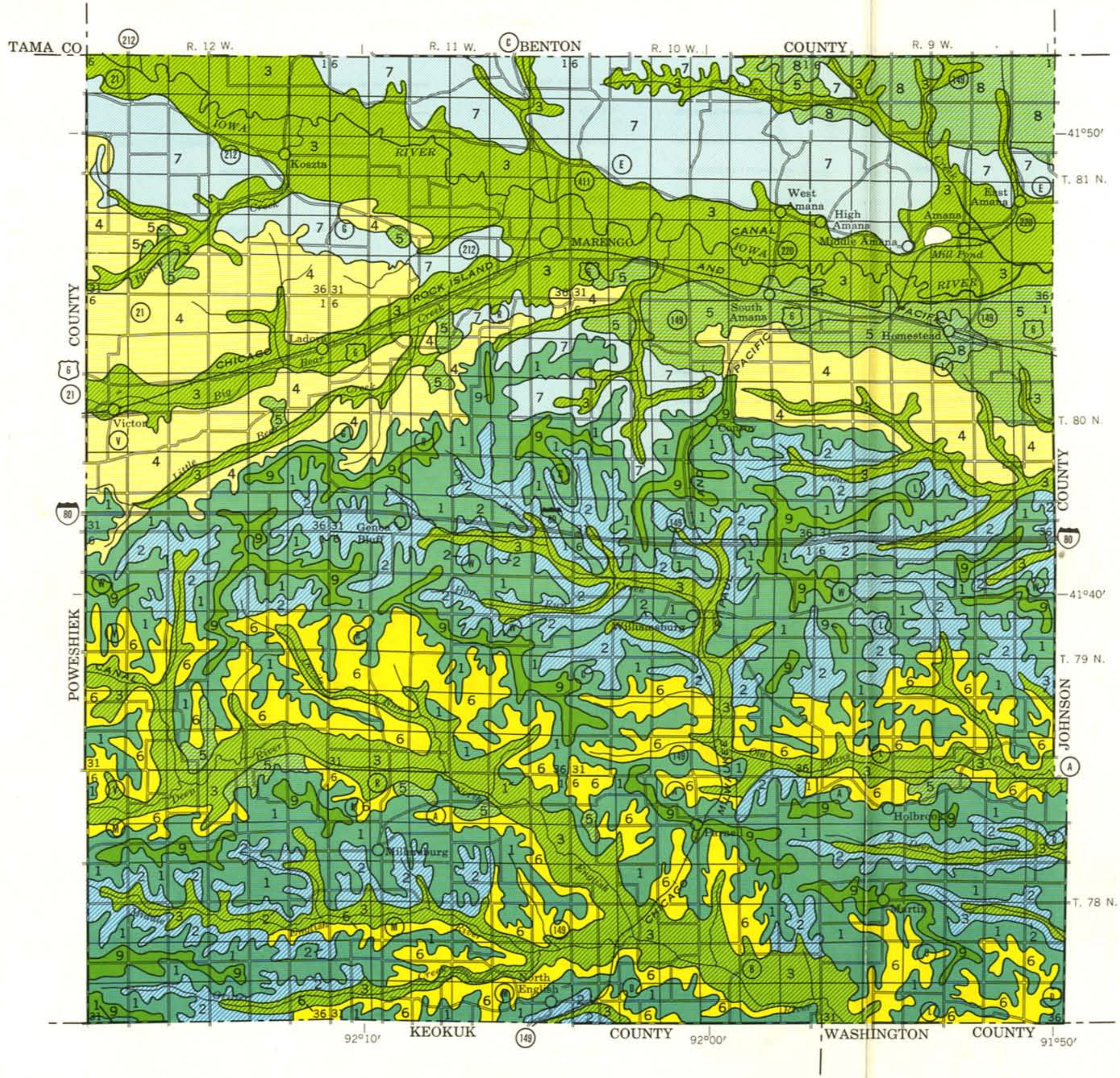


U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

IOWA AGRICULTURAL EXPERIMENT STATION

N

GENERAL SOIL MAP
IOWA COUNTY, IOWA

Scale 1:190,080

1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

1 Otley-Ladoga-Clinton association: Gently sloping or moderately sloping soils that formed from loess on uplands

2 Ladoga-Otley-Adair-Shelby association: Strongly sloping to steep, dark colored and moderately dark colored soils that formed from loess or glacial till on uplands

3 Colo-Bremer-Nevin-Nodaway association: Nearly level or undulating soils on bottom lands

4 Tama-Downs-Shelby association: Nearly level to steep, dark colored and moderately dark colored soils that formed from loess and glacial till on uplands

5 Chelsea-Fayette-Hagener-Tama association: Undulating to hilly sandy and silty soils

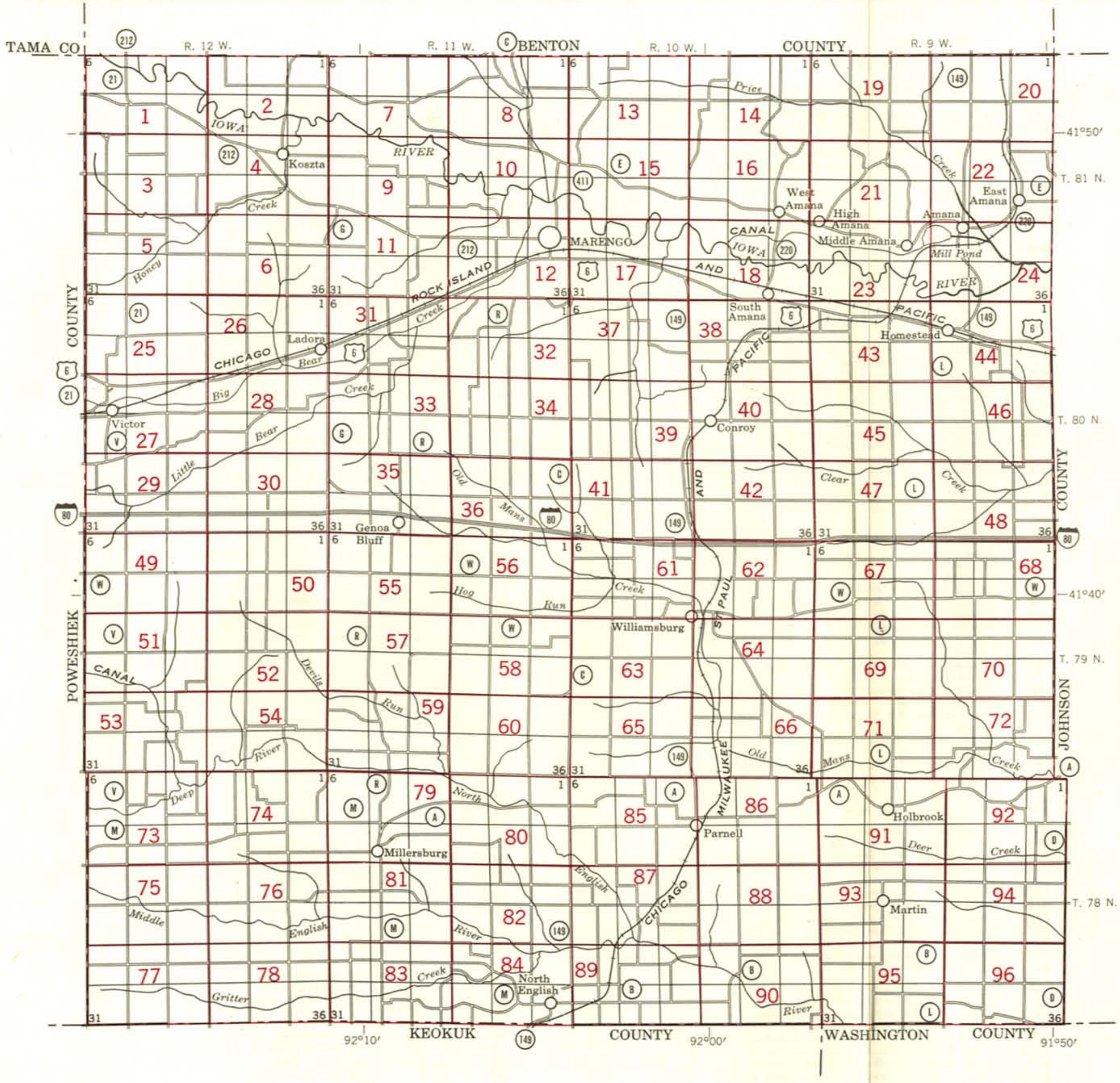
6 Clinton-Lindley-Gara-Keswick association: Strongly sloping to steep, light-colored and moderately dark colored soils that formed from loess and glacial till on uplands

7 Fayette-Downs association: Gently sloping to steep, light-colored and moderately dark colored soils that formed from loess on uplands

8 Bassett-Dinsdale-Kenyon association: Gently sloping or sloping, dark colored and moderately dark colored soils that developed from loess over loam till and till on uplands

9 Mahaska-Taintor-Givin association: Nearly level, imperfectly drained and poorly drained soils that formed from loess on uplands

January 1966



INDEX TO MAP SHEETS

IOWA COUNTY, IOWA

N

Scale 1:190,080

1 0 1 2 3 4 Miles

IOWA COUNTY, IOWA

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Dual
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings

- School
- Church
- Station

Mines and Quarries

Mine dump

Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant

DRAINAGE

Streams

- Perennial
- Intermittent, unclass.
- Crossable with tillage implements

Canals and ditches — CANAL, DITCH

Lakes and ponds

- Perennial
- Intermittent

Wells — flowing

Springs

Marsh

Wet spot

Alluvial fan

Drainage ends

RELIEF

Escarpments

- Bedrock
- Other

Prominent peaks

Depressions — Large, Small

- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

Soil boundary and symbol — Dx

Gravel

Stones

Rock outcrops

Chert fragments

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gullies

Outcrop of moderately fine textured glacial till

Outcrop of fine textured glacial till

Small area of calcareous soil

SOIL LEGEND

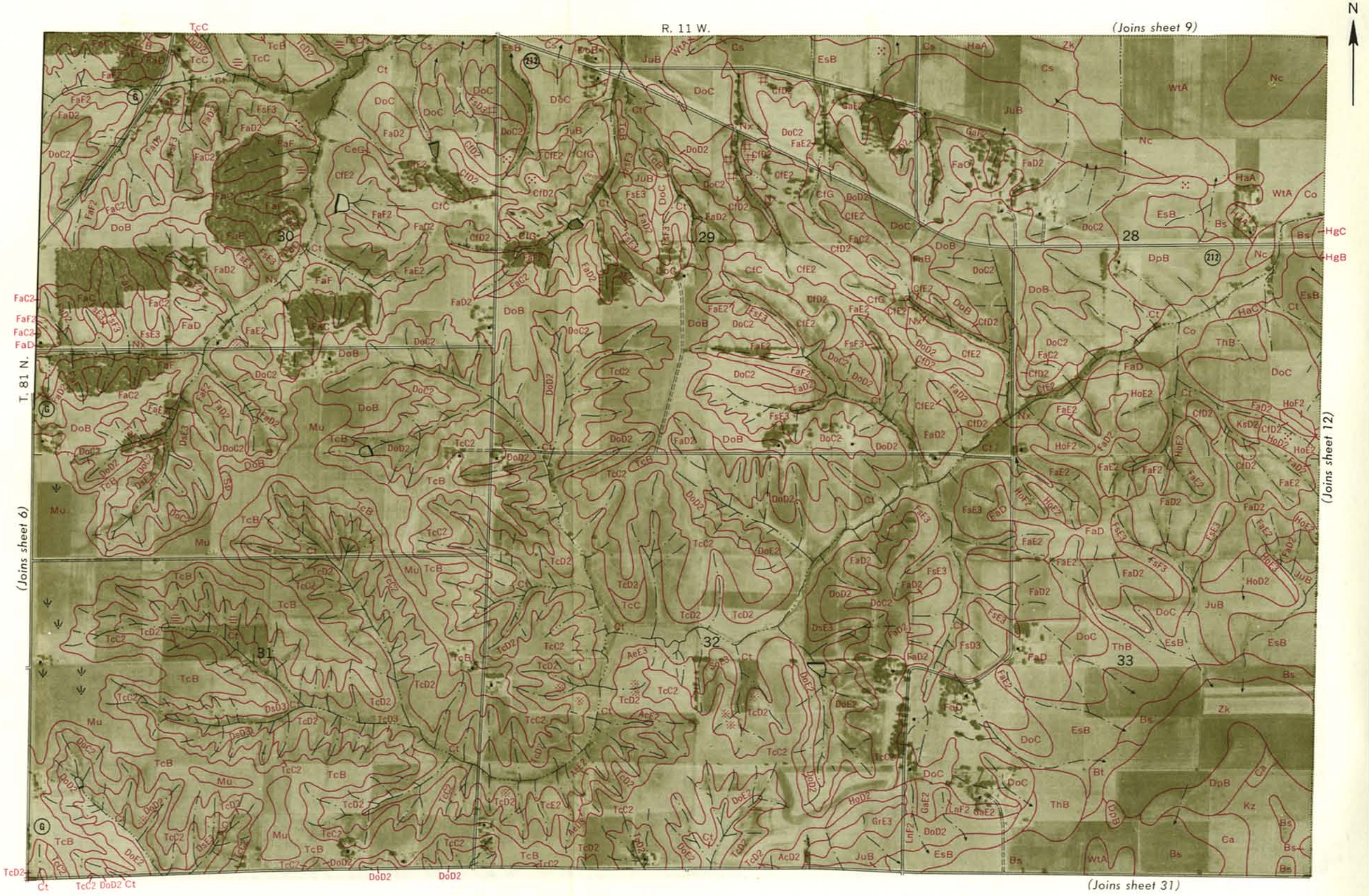
The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, F, or G, shows the slope. Most symbols without a slope letter are those of nearly level soils. Soils that are named as moderately eroded or severely eroded have a final number, 2 or 3, in their symbol.

SYMBOL	NAME
AaC2	Adair clay loam, 5 to 9 percent slopes, moderately eroded
AaD2	Adair clay loam, 9 to 14 percent slopes, moderately eroded
AaE2	Adair clay loam, 14 to 18 percent slopes, moderately eroded
AcD2	Adair clay loam, thin solum, 9 to 14 percent slopes, moderately eroded
AcE2	Adair clay loam, thin solum, 14 to 18 percent slopes, moderately eroded
AdD3	Adair soils, 9 to 14 percent slopes, severely eroded
AdE3	Adair soils, 14 to 18 percent slopes, severely eroded
AeD3	Adair soils, thin solum, 9 to 14 percent slopes, severely eroded
AeE3	Adair soils, thin solum, 14 to 18 percent slopes, severely eroded
AeF3	Adair soils, thin solum, 18 to 25 percent slopes, severely eroded
Al	Alluvial land
Am	Amana silt loam
An	Amana–Lawson–Nodaway complex
As	Atterberry silt loam
At	Atterberry silt loam, benches
BaC2	Bassett loam, 5 to 9 percent slopes, moderately eroded
BaD2	Bassett loam, 9 to 14 percent slopes, moderately eroded
BaE2	Bassett loam, 14 to 18 percent slopes, moderately eroded
BaF2	Bassett loam, 18 to 25 percent slopes, moderately eroded
BeD3	Bassett soils, 9 to 14 percent slopes, severely eroded
BeE3	Bassett soils, 14 to 18 percent slopes, severely eroded
BrA	Bertrand silt loam, 0 to 2 percent slopes
BrB	Bertrand silt loam, 2 to 5 percent slopes
BrC2	Bertrand silt loam, 5 to 9 percent slopes, moderately eroded
Bs	Bremer silty clay loam
Bt	Bremer silt loam, overwash
Ca	Chariton silt loam
CeB	Chelsea fine sand, 2 to 9 percent slopes
CeD	Chelsea fine sand, 9 to 18 percent slopes
CeG	Chelsea fine sand, 18 to 40 percent slopes
CfC	Chelsea–Fayette–Lamont complex, 5 to 9 percent slopes
CfD	Chelsea–Fayette–Lamont complex, 9 to 14 percent slopes
CfD2	Chelsea–Fayette–Lamont complex, 9 to 14 percent slopes, moderately eroded
CfE	Chelsea–Fayette–Lamont complex, 14 to 18 percent slopes
CfE2	Chelsea–Fayette–Lamont complex, 14 to 18 percent slopes, moderately eroded
CfG	Chelsea–Fayette–Lamont complex, 18 to 40 percent slopes
ClB	Clinton silt loam, 2 to 5 percent slopes
ClC	Clinton silt loam, 5 to 9 percent slopes
ClC2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded
ClD	Clinton silt loam, 9 to 14 percent slopes
ClD2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded
ClE2	Clinton silt loam, 14 to 18 percent slopes, moderately eroded
ClF2	Clinton silt loam, 18 to 25 percent slopes, moderately eroded
CnD3	Clinton soils, 9 to 14 percent slopes, severely eroded
CnE3	Clinton soils, 14 to 18 percent slopes, severely eroded
Co	Colo silty clay loam
Cs	Colo silt loam, overwash
Ct	Colo–Ely complex, 1 to 5 percent slopes
Cu	Coppock silt loam
DcA	Dickinson sandy loam, 0 to 2 percent slopes
DcB	Dickinson sandy loam, 2 to 5 percent slopes
DcC	Dickinson sandy loam, 5 to 9 percent slopes
DdB	Dinsdale silty clay loam, 2 to 5 percent slopes
DdC	Dinsdale silty clay loam, 5 to 9 percent slopes
DoB	Downs silt loam, 2 to 5 percent slopes
DoC	Downs silt loam, 5 to 9 percent slopes
DoC2	Downs silt loam, 5 to 9 percent slopes, moderately eroded
DoD2	Downs silt loam, 9 to 14 percent slopes, moderately eroded
DoE2	Downs silt loam, 14 to 18 percent slopes, moderately eroded
DpB	Downs silt loam, benches, 2 to 5 percent slopes
DsD3	Downs soils, 9 to 14 percent slopes, severely eroded
DsE3	Downs soils, 14 to 18 percent slopes, severely eroded
EsB	Ely silt loam, 2 to 5 percent slopes
FaB	Fayette silt loam, 2 to 5 percent slopes
FaC	Fayette silt loam, 5 to 9 percent slopes
FaC2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded
FaD	Fayette silt loam, 9 to 14 percent slopes
FaD2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded
FaE	Fayette silt loam, 14 to 18 percent slopes
FaE2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded
FaF	Fayette silt loam, 18 to 25 percent slopes
FaF2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded
FaG	Fayette silt loam, 25 to 40 percent slopes
FbB	Fayette silt loam, benches, 2 to 5 percent slopes
FsD3	Fayette soils, 9 to 14 percent slopes, severely eroded
FsE3	Fayette soils, 14 to 18 percent slopes, severely eroded
FsF3	Fayette soils, 18 to 25 percent slopes, severely eroded
GaC2	Gara loam, 5 to 9 percent slopes, moderately eroded
GaD2	Gara loam, 9 to 14 percent slopes, moderately eroded
GaE2	Gara loam, 14 to 18 percent slopes, moderately eroded
GaF2	Gara loam, 18 to 25 percent slopes, moderately eroded
GrD3	Gara soils, 9 to 14 percent slopes, severely eroded
GrE3	Gara soils, 14 to 18 percent slopes, severely eroded
GrF3	Gara soils, 18 to 25 percent slopes, severely eroded
Gs	Givin silt loam
Gu	Gullied land
HaA	Hagener fine sand, 0 to 2 percent slopes
HaB	Hagener fine sand, 2 to 5 percent slopes
HaC	Hagener fine sand, 5 to 9 percent slopes
HaD	Hagener fine sand, 9 to 14 percent slopes
HaE	Hagener fine sand, 14 to 25 percent slopes
HgB	Hagener–Tama complex, 2 to 5 percent slopes
HgC	Hagener–Tama complex, 5 to 9 percent slopes
HgC2	Hagener–Tama complex, 5 to 9 percent slopes, moderately eroded
HgD2	Hagener–Tama complex, 9 to 14 percent slopes, moderately eroded
HgE2	Hagener–Tama complex, 14 to 18 percent slopes, moderately eroded
HoD2	Hopper silt loam, 9 to 14 percent slopes, moderately eroded
HoE2	Hopper silt loam, 14 to 18 percent slopes, moderately eroded
HoE3	Hopper silt loam, 14 to 18 percent slopes, severely eroded
HoF2	Hopper silt loam, 18 to 25 percent slopes, moderately eroded
Ja	Jackson silt loam
JuB	Judson silt loam, 2 to 6 percent slopes
KnB	Kenyon loam, 2 to 5 percent slopes
KnC	Kenyon loam, 5 to 9 percent slopes
KnC2	Kenyon loam, 5 to 9 percent slopes, moderately eroded
KnD2	Kenyon loam, 9 to 14 percent slopes, moderately eroded
Ko	Keomah silt loam
KsD2	Keswick loam, 9 to 14 percent slopes, moderately eroded
KsE2	Keswick loam, 14 to 18 percent slopes, moderately eroded
KsF2	Keswick loam, 18 to 25 percent slopes, moderately eroded
KwD3	Keswick soils, 9 to 14 percent slopes, severely eroded
KwE3	Keswick soils, 14 to 18 percent slopes, severely eroded
KwF3	Keswick soils, 18 to 25 percent slopes, severely eroded
Kz	Koszta silt loam
LaB	Ladoga silt loam, 2 to 5 percent slopes
LaC	Ladoga silt loam, 5 to 9 percent slopes
LaC2	Ladoga silt loam, 5 to 9 percent slopes, moderately eroded
LaD	Ladoga silt loam, 9 to 14 percent slopes
LaD2	Ladoga silt loam, 9 to 14 percent slopes, moderately eroded
LaE2	Ladoga silt loam, 14 to 18 percent slopes, moderately eroded
LbB	Ladoga silt loam, benches, 2 to 5 percent slopes
LdD3	Ladoga soils, 9 to 14 percent slopes, severely eroded
LdE3	Ladoga soils, 14 to 18 percent slopes, severely eroded
Le	Lawler loam
Lh	Lawson silt loam
LnD2	Lindley loam, 9 to 14 percent slopes, moderately eroded
LnE2	Lindley loam, 14 to 18 percent slopes, moderately eroded
LnF	Lindley loam, 18 to 25 percent slopes
LnF2	Lindley loam, 18 to 25 percent slopes, moderately eroded
LnG	Lindley loam, 25 to 40 percent slopes
LsD3	Lindley soils, 9 to 14 percent slopes, severely eroded
LsE3	Lindley soils, 14 to 18 percent slopes, severely eroded
LsF3	Lindley soils, 18 to 25 percent slopes, severely eroded
Ma	Mahaska silty clay loam
Mu	Muscatine silty clay loam
Nc	Nevin silty clay loam
Nd	Nodaway silt loam
Nh	Nodaway silt loam, channeled
Ns	Nodaway silt loam, silty clay loam substratum
Nx	Nodaway–Ely complex
OcB	Otley silty clay loam, 2 to 5 percent slopes
OcC	Otley silty clay loam, 5 to 9 percent slopes
OcC2	Otley silty clay loam, 5 to 9 percent slopes, moderately eroded
OcD2	Otley silty clay loam, 9 to 14 percent slopes, moderately eroded
OcD3	Otley silty clay loam, 9 to 14 percent slopes, severely eroded
OcE2	Otley silty clay loam, 14 to 18 percent slopes, moderately eroded
OrB	Otley silty clay loam, benches, 2 to 5 percent slopes
ShC	Shelby loam, 5 to 9 percent slopes
ShC2	Shelby loam, 5 to 9 percent slopes, moderately eroded
ShD2	Shelby loam, 9 to 14 percent slopes, moderately eroded
ShE2	Shelby loam, 14 to 18 percent slopes, moderately eroded
ShF2	Shelby loam, 18 to 25 percent slopes, moderately eroded
SoD3	Shelby soils, 9 to 14 percent slopes, severely eroded
SoE3	Shelby soils, 14 to 18 percent slopes, severely eroded
Sp	Sperry silt loam
Sr	Stronghurst silt loam
St	Stronghurst silt loam, benches
Ta	Taintor silty clay loam
TcB	Tama silty clay loam, 2 to 5 percent slopes
TcC	Tama silty clay loam, 5 to 9 percent slopes
TcC2	Tama silty clay loam, 5 to 9 percent slopes, moderately eroded
TcD2	Tama silty clay loam, 9 to 14 percent slopes, moderately eroded
TcD3	Tama silty clay loam, 9 to 14 percent slopes, severely eroded
TcE2	Tama silty clay loam, 14 to 18 percent slopes, moderately eroded
ThA	Tama silty clay loam, benches, 0 to 2 percent slopes
ThB	Tama silty clay loam, benches, 2 to 5 percent slopes
TmB	Tell silt loam, 2 to 5 percent slopes
TmC	Tell silt loam, 5 to 9 percent slopes
TmC2	Tell silt loam, 5 to 9 percent slopes, moderately eroded
TmD2	Tell silt loam, 9 to 14 percent slopes, moderately eroded
Ud	Udolpho loam
Wa	Wabash silty clay
Wb	Walford silt loam, benches
WkA	Watkins silt loam, 0 to 2 percent slopes
WkB	Watkins silt loam, 2 to 5 percent slopes
WmB	Waubeek silt loam, 2 to 5 percent slopes
WmC2	Waubeek silt loam, 5 to 9 percent slopes, moderately eroded
WnA	Waukegan loam, 0 to 2 percent slopes
WnB	Waukegan loam, 2 to 5 percent slopes
WnC	Waukegan loam, 5 to 9 percent slopes
WsB	Waukegan silt loam, 2 to 5 percent slopes
WsC	Waukegan silt loam, 5 to 9 percent slopes
WtA	Wiota silt loam, 0 to 2 percent slopes
WtB	Wiota silt loam, 2 to 5 percent slopes
Zk	Zook silty clay loam
Zo	Zook silt loam, overwash

Soil map constructed 1965 by Cartographic Division, Soil Conservation Service, USDA, from 1956 aerial photographs. Controlled mosaic based on Iowa plane coordinate system, south zone, Lambert conformal conic projection, 1927 North American datum.


BENTON COUNTY
R. 12 W.
N
T. 81 N.
POWESHIEK COUNTY
IOWA
RIVER
(Joins sheet 2)
(Joins sheet 3)


N
(Joins sheet 8)
R. 11 W.
T. 81 N.
(Joins sheet 9)
(Joins sheet 15)
(Joins sheet 12)
15
14
13
22
23
24
GRAVEL PIT
IOWA
RIVER
BIG BEAR CREEK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T. 81 N.
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29
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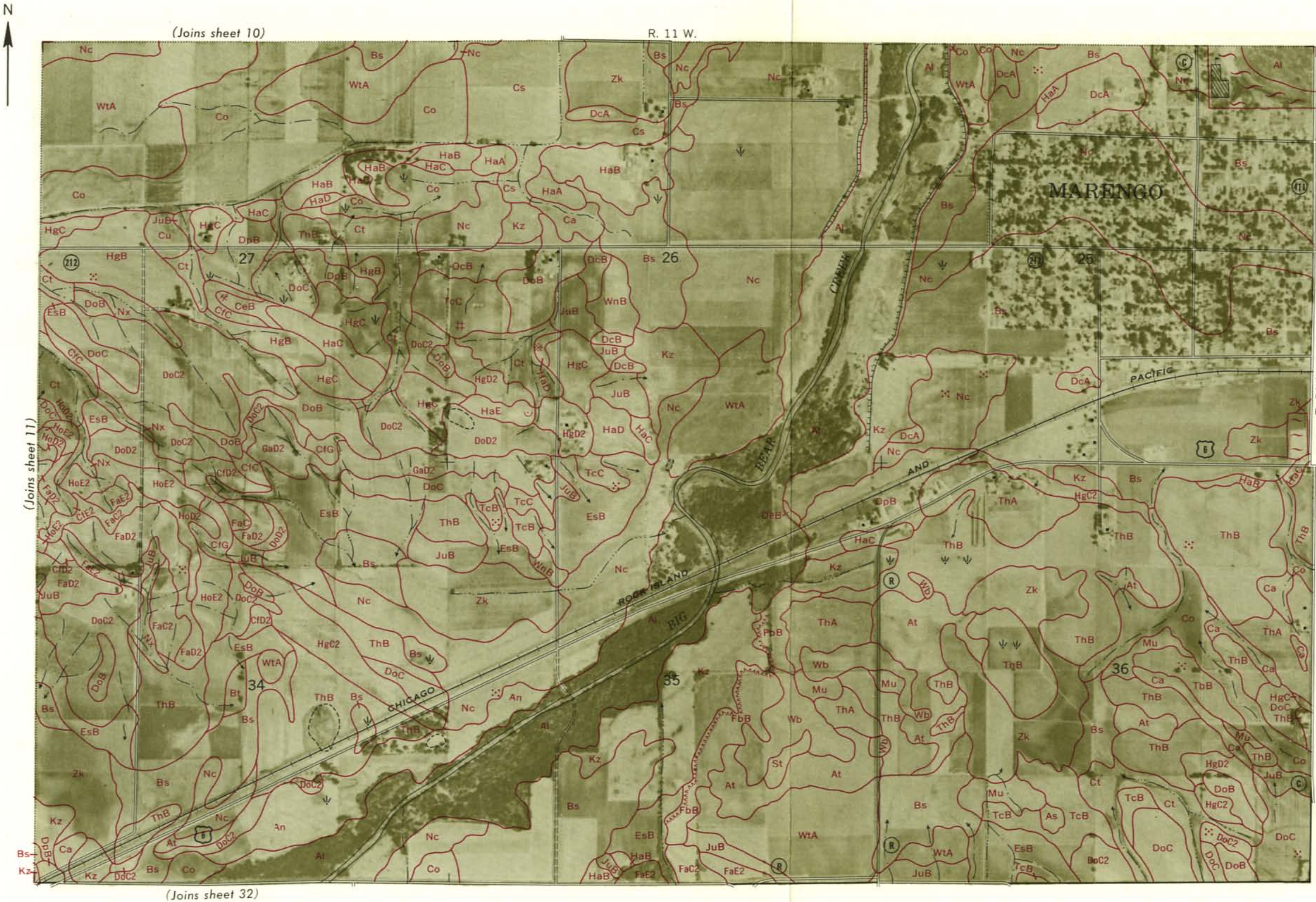
31
32
33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R. 11 W.
MARENGO
T. 81 N.
(Joins sheet 11)
(Joins sheet 17)
(Joins sheet 32)
BEAR CREEK
BIG
CHICAGO ROCK ISLAND AND PACIFIC
27
26
25
34
35
36


BENTON COUNTY
R. 10 W.
N
T. 81 N.
Price Creek
(Joins sheet 8)
(Joins sheet 14)
(Joins sheet 15)


N
R. 10 W.
BENTON COUNTY
T. 81 N.
Price
Creek
Price
Creek
(Joins sheet 13)
(Joins sheet 19)
(Joins sheet 16)
1
2
3
10
11
12


N
R. 10 W.
(Joins sheet 13)
T. 81 N.
(Joins sheet 10)
(Joins sheet 16)
(Joins sheet 17)
IOWA
RIVER
IOWA R
18
17
16
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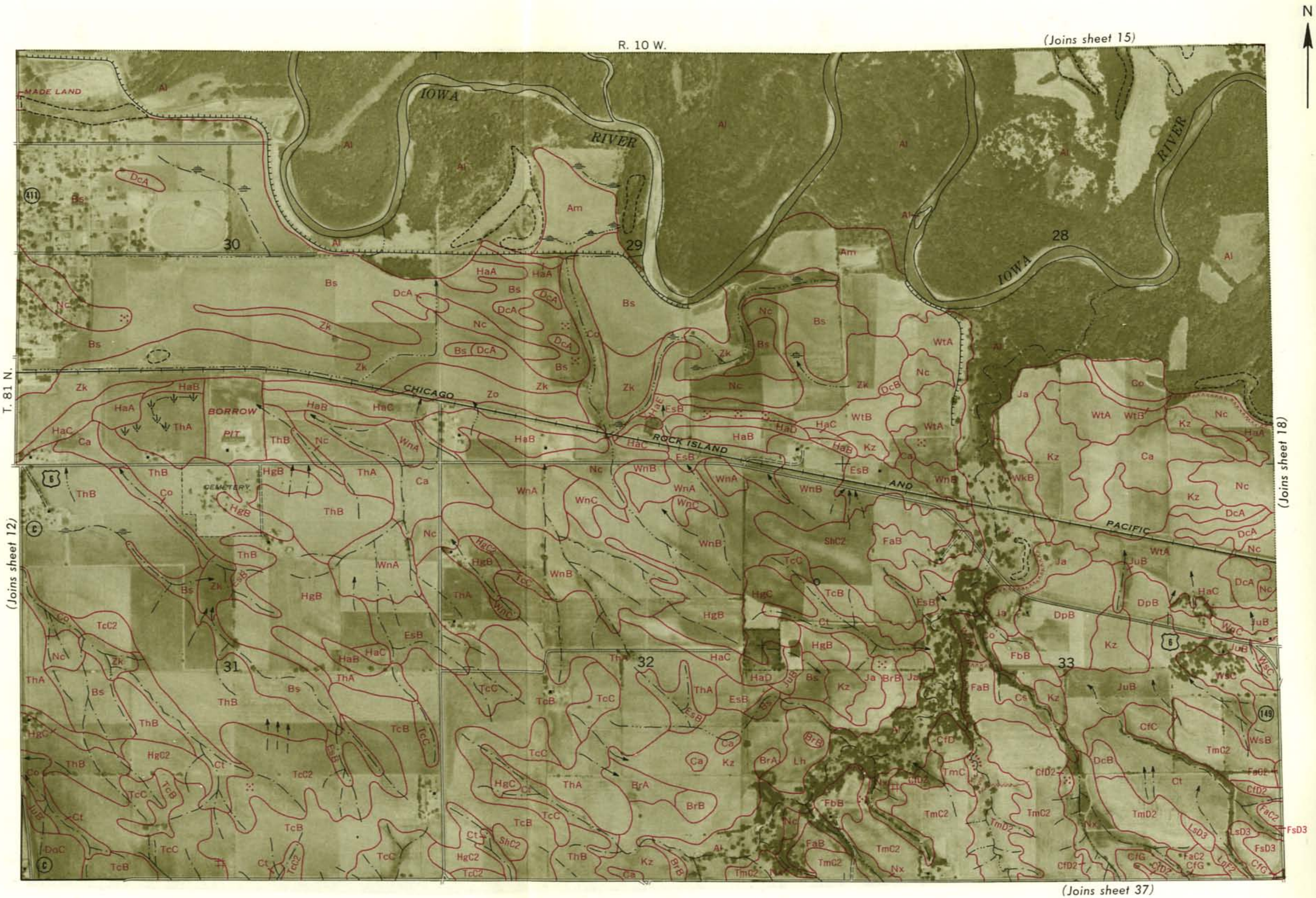
21

IOWA COUNTY, IOWA — SHEET NUMBER 16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R. 10 W.
T. 81 N.
(Joins sheet 12)
(Joins sheet 18)
(Joins sheet 37)
MADE LAND
IOWA
RIVER
IOWA
RIVER
30
29
28
31
32
33
CHICAGO
ROCK ISLAND
AND
PACIFIC
BORROW
PIT
CEMETERY

N

(Joins sheet 16)

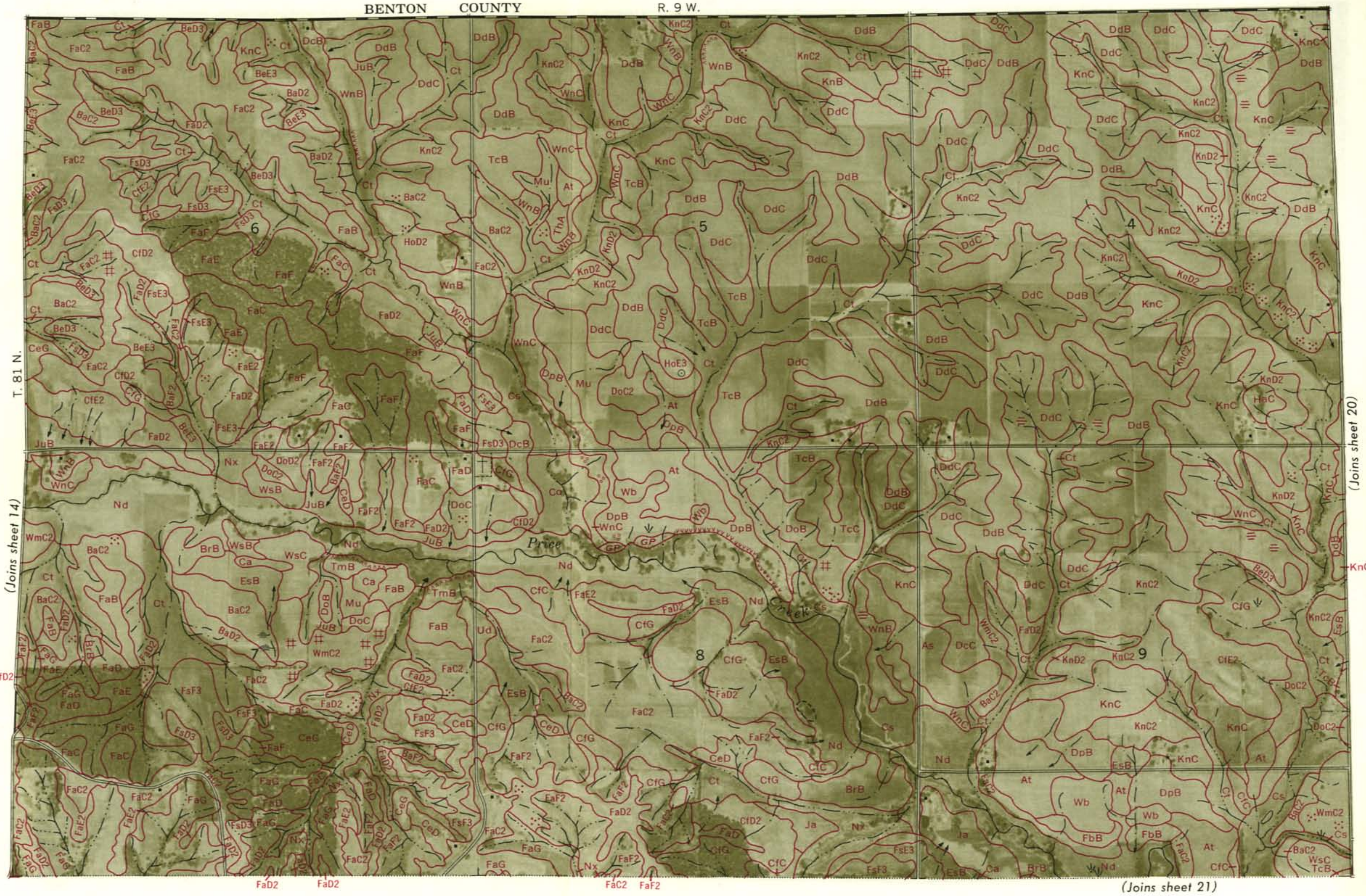
R. 10 W.

(Joins sheet 17)

(Joins sheet 23)

(Joins sheet 38)

N


BENTON COUNTY
R. 9 W.
T. 81 N.
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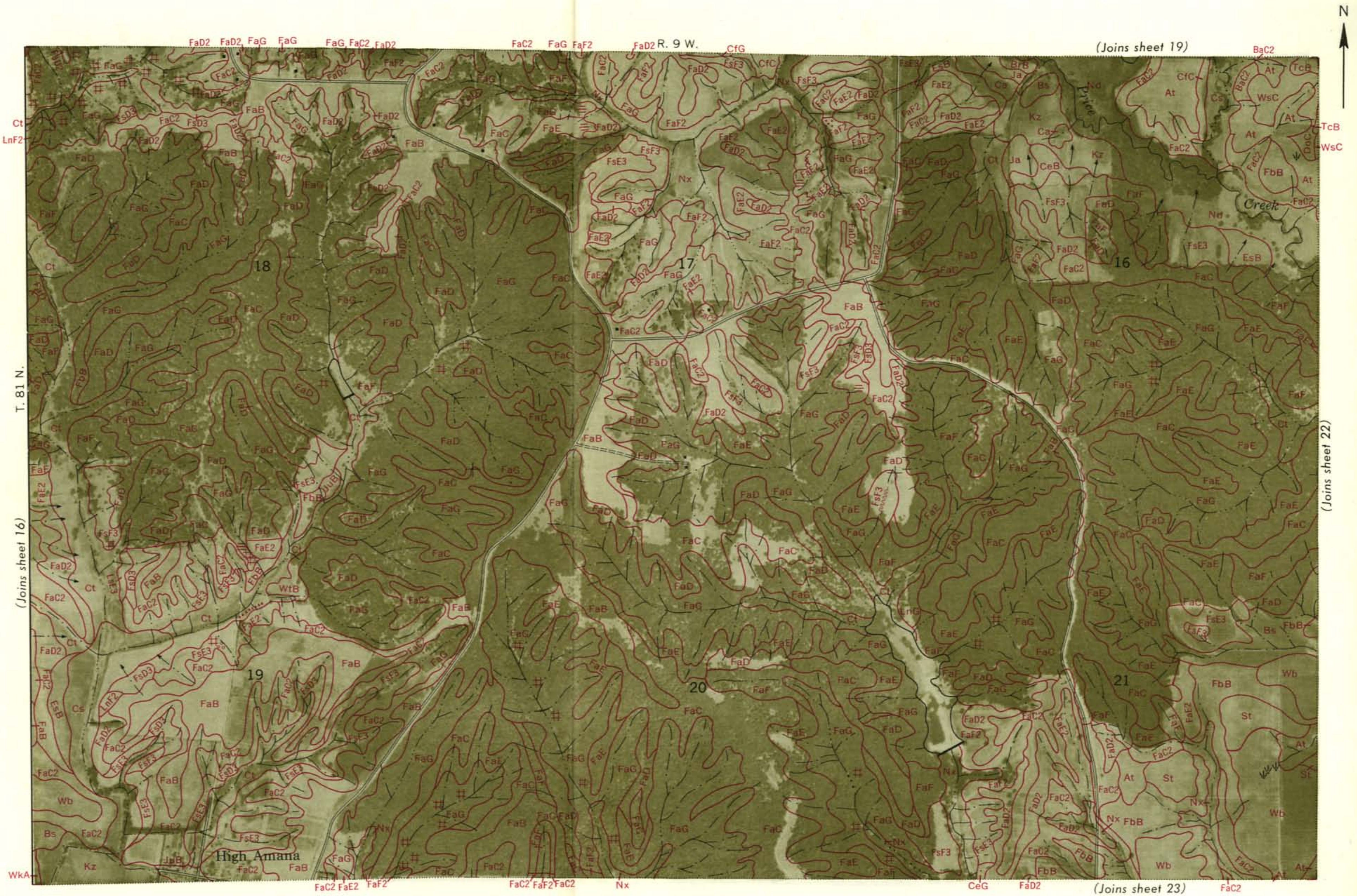
(Joins sheet 20)
(Joins sheet 21)
Price Creek
6
5
4
7
8
9


N
BENTON COUNTY
R. 12 W.
T. 81 N.
(Joins sheet 1)
(Joins sheet 7)
(Joins sheet 4)
IOWA
RIVER
Honey Creek
1
2
3
10
11
12


N
R. 9 W.
BENTON COUNTY
T. 81 N.
JOHNSON COUNTY
(Joins sheet 19)
(Joins sheet 22)
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
149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R. 9 W.
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(Joins sheet 22)
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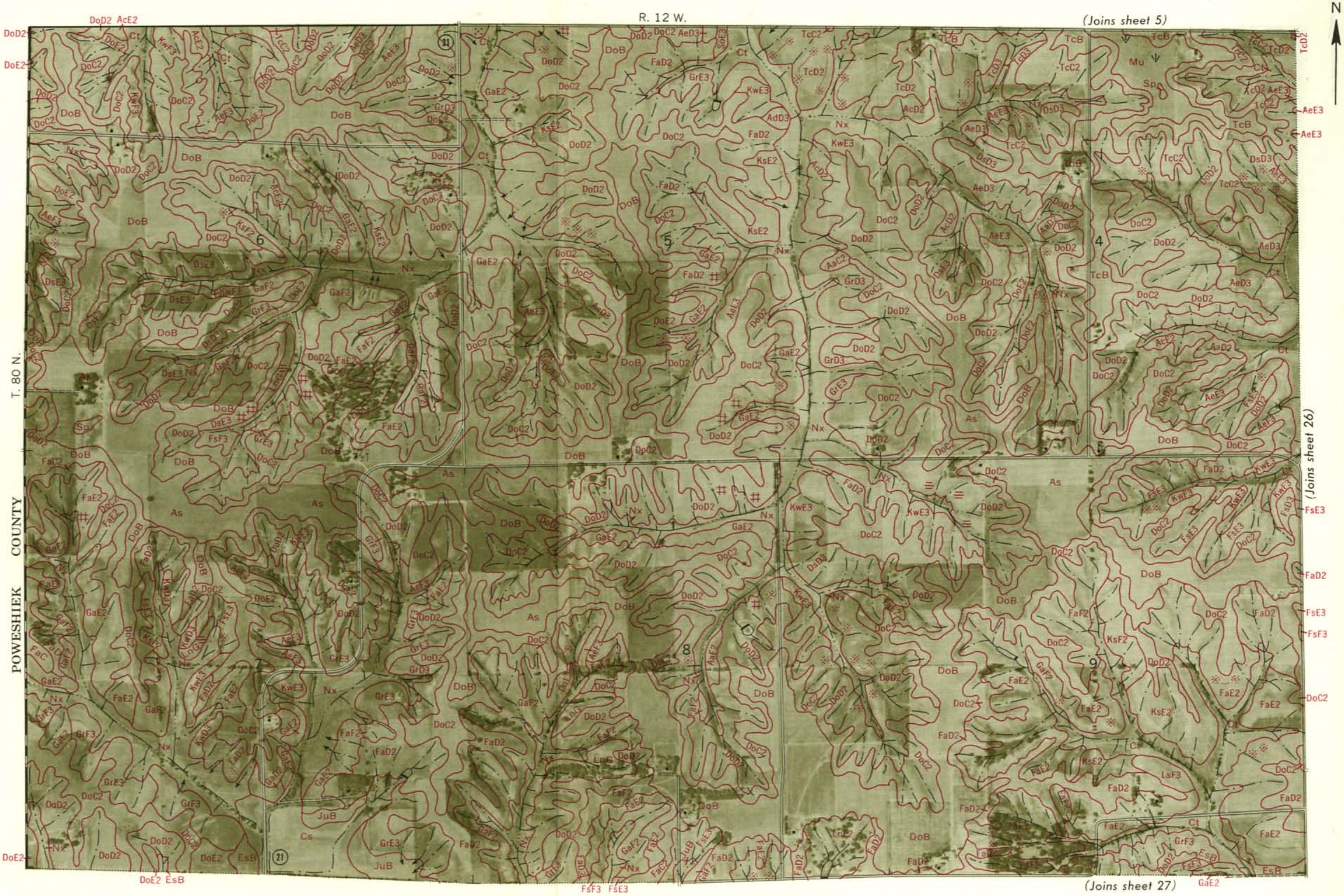
(Joins sheet 16)
T. 81 N.
Price
Creek
18
17
16
19
20
21
High Amana


N
(Joins sheet 20)
R. 9 W.
(Joins sheet 21)
(Joins sheet 24)
T. 81 N.
JOHNSON COUNTY
15
14
13
22
23
24
East Amana
Creek
CHICAGO
MILWAUKEE
ST. PAUL
AND
PACIFIC


N
R. 9 W.
(Joins sheet 21)
T. 81 N.
(Joins sheet 18)
(Joins sheet 24)
(Joins sheet 43)
High Amana
Middle Amana
MILL POND
CANAL
IOWA RIVER
IOWA RIVER
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
RI & P
220
29
30
28
31
32
33


N
(Joins sheet 22)
R. 9 W.
(Joins sheet 23)
(Joins sheet 44)
T. 81 N.
JOHNSON COUNTY
MILL POND
Amana
Price Creek
CANAL
CHICAGO MILWAUKEE ST PAUL PACIFIC
IOWA RIVER
27
26
25
34
35
36
220
149
149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R. 12 W.
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(Joins sheet 27)
T. 80 N.
POWESHIEK COUNTY
6
5
4
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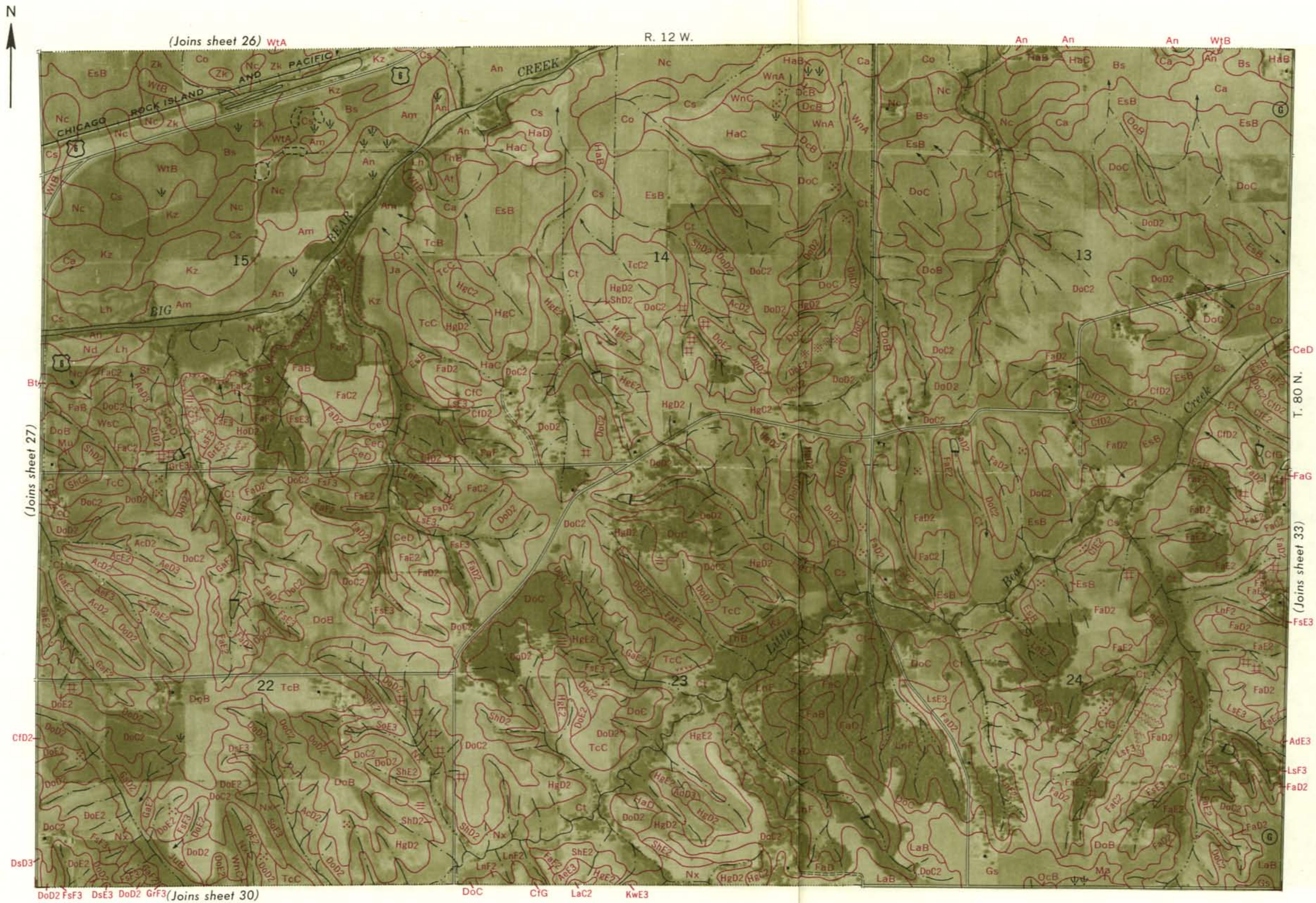
9
21


N
(Joins sheet 6)
R. 12 W.
T. 80 N.
(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 28)
3
2
1
10
11
12
Ladora
CHICAGO
ROCK ISLAND
AND
PACIFIC
BIG
BEAR
CREEK


N
(Joins sheet 25)
R. 12 W.
T. 80 N.
POWESHIEK COUNTY
(Joins sheet 28)
(Joins sheet 29)
Victor
BIG BEAR CREEK
CHICAGO ROCK ISLAND AND PACIFIC
BORROW PIT
B.P.
18
17
16
19
20
21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T. 80 N.
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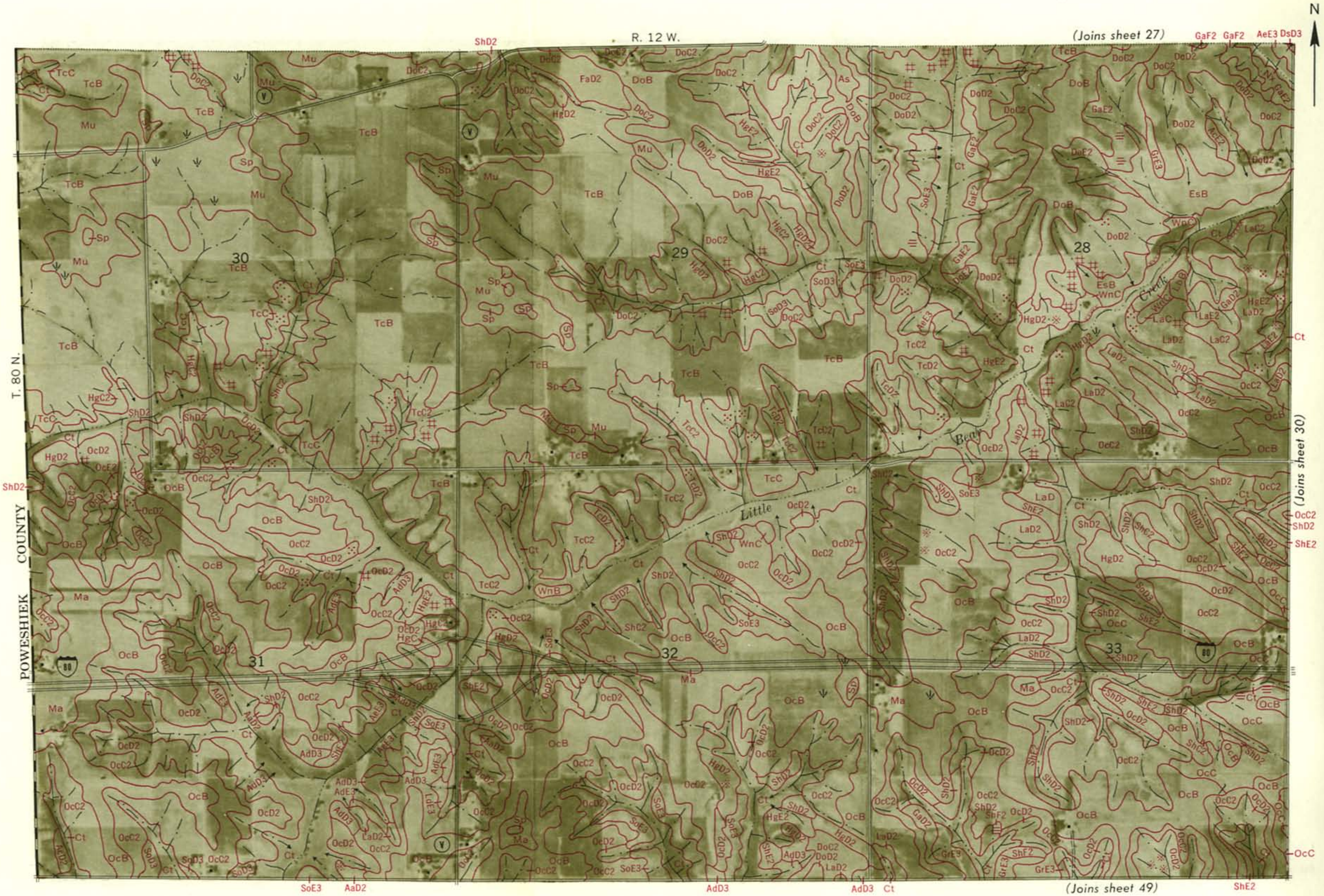
CHICAGO ROCK ISLAND AND PACIFIC
BIG BEAR CREEK
Little Bear Creek
15
14
13
22
23
24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R. 12 W.
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T. 80 N.
POWESHIEK COUNTY
30
29
28
31
32
33
Little
Bear
Creek
80


N
R. 12 W.
(Joins sheet 1)
T. 81 N.
POWESHIEK COUNTY
(Joins sheet 4)
(Joins sheet 5)
16
17
18
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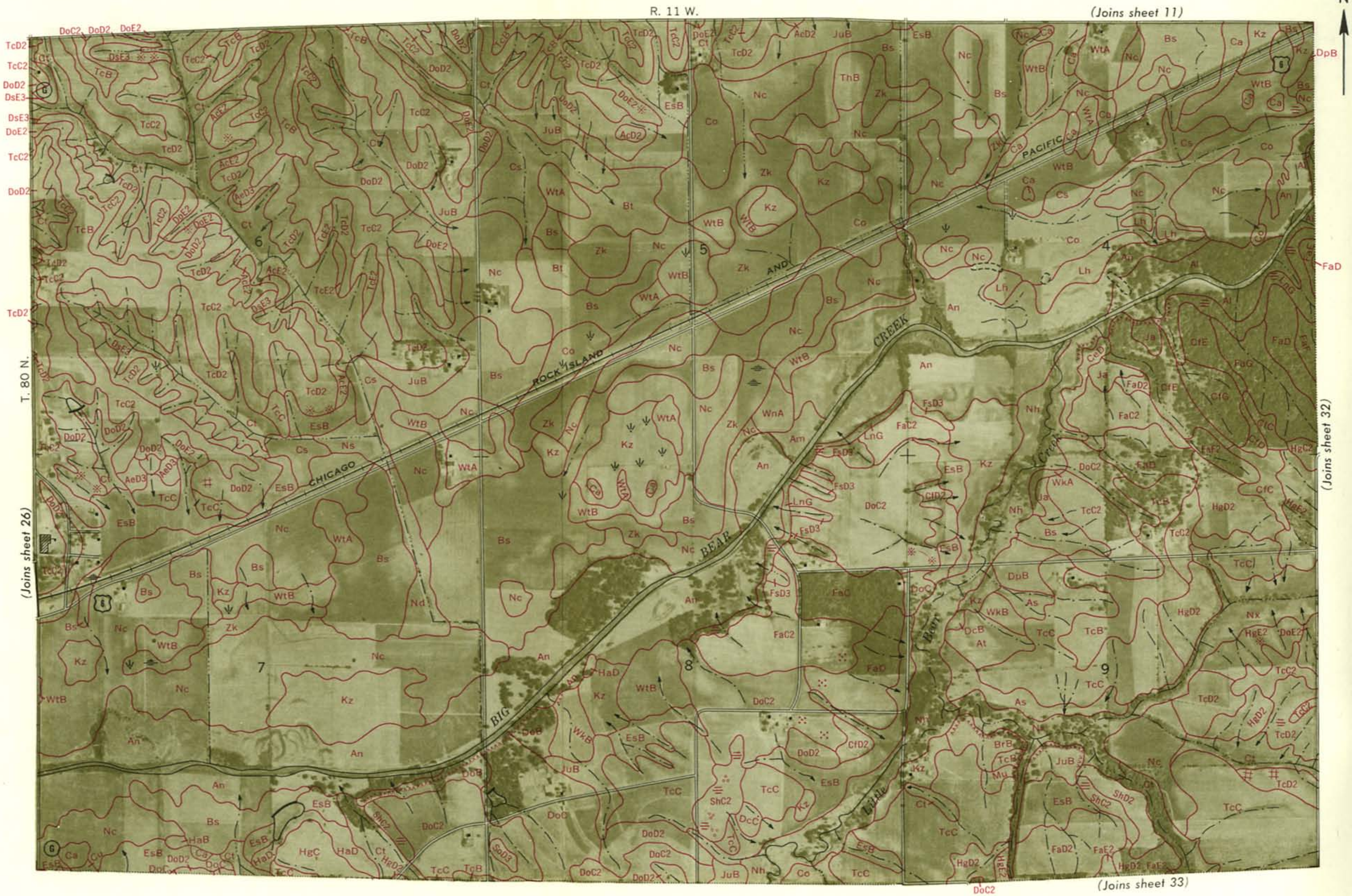
21


N
(Joins sheet 28)
R. 12 W.
(Joins sheet 29)
(Joins sheet 35)
T. 80 N.
(Joins sheet 50)
Little
Bear
Creek
27
26
25
34
35
36
80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T. 80 N.
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CHICAGO ROCK ISLAND AND PACIFIC
BIG BEAR CREEK
Little Bear Creek
5
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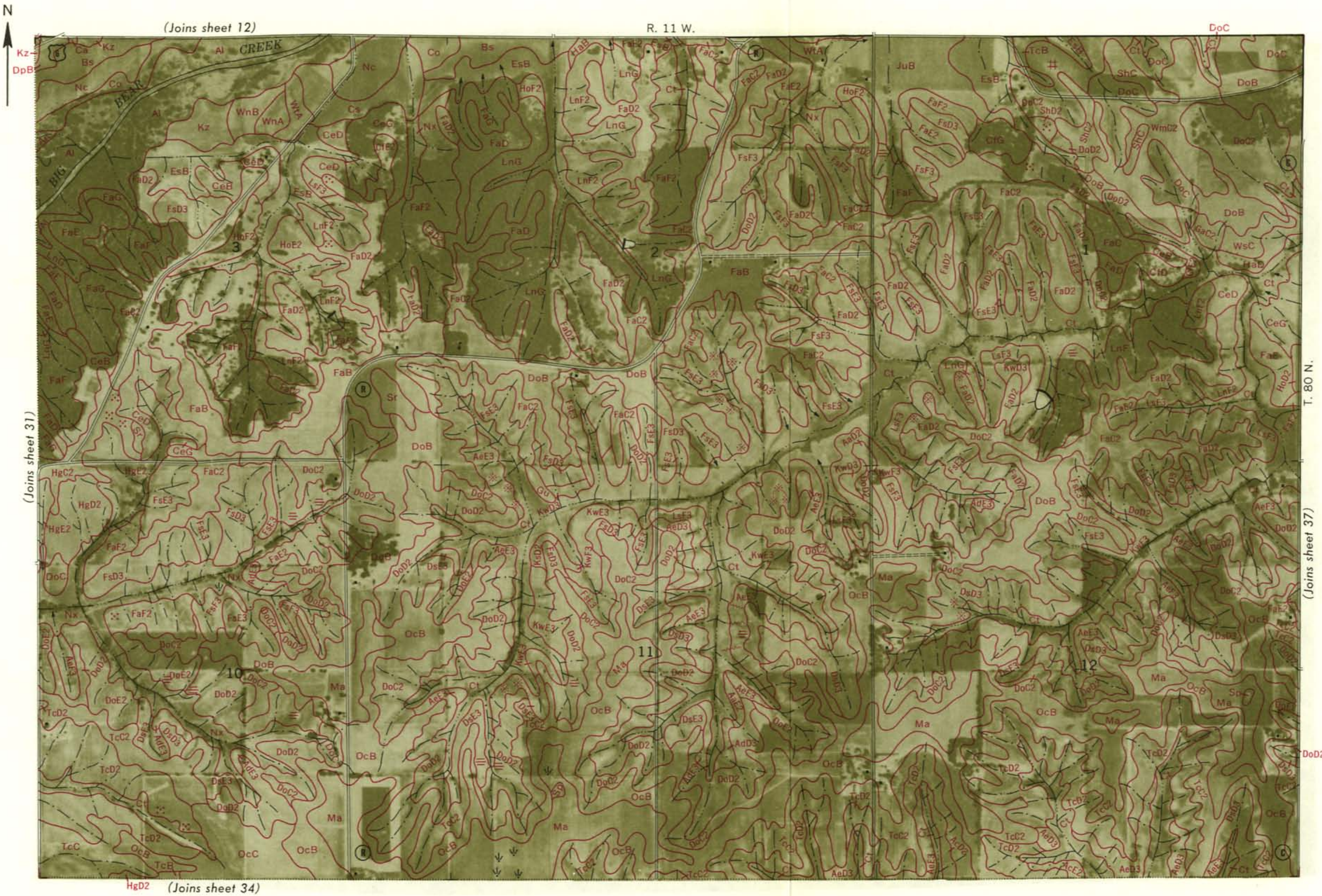
9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R. 11 W.
T. 80 N.
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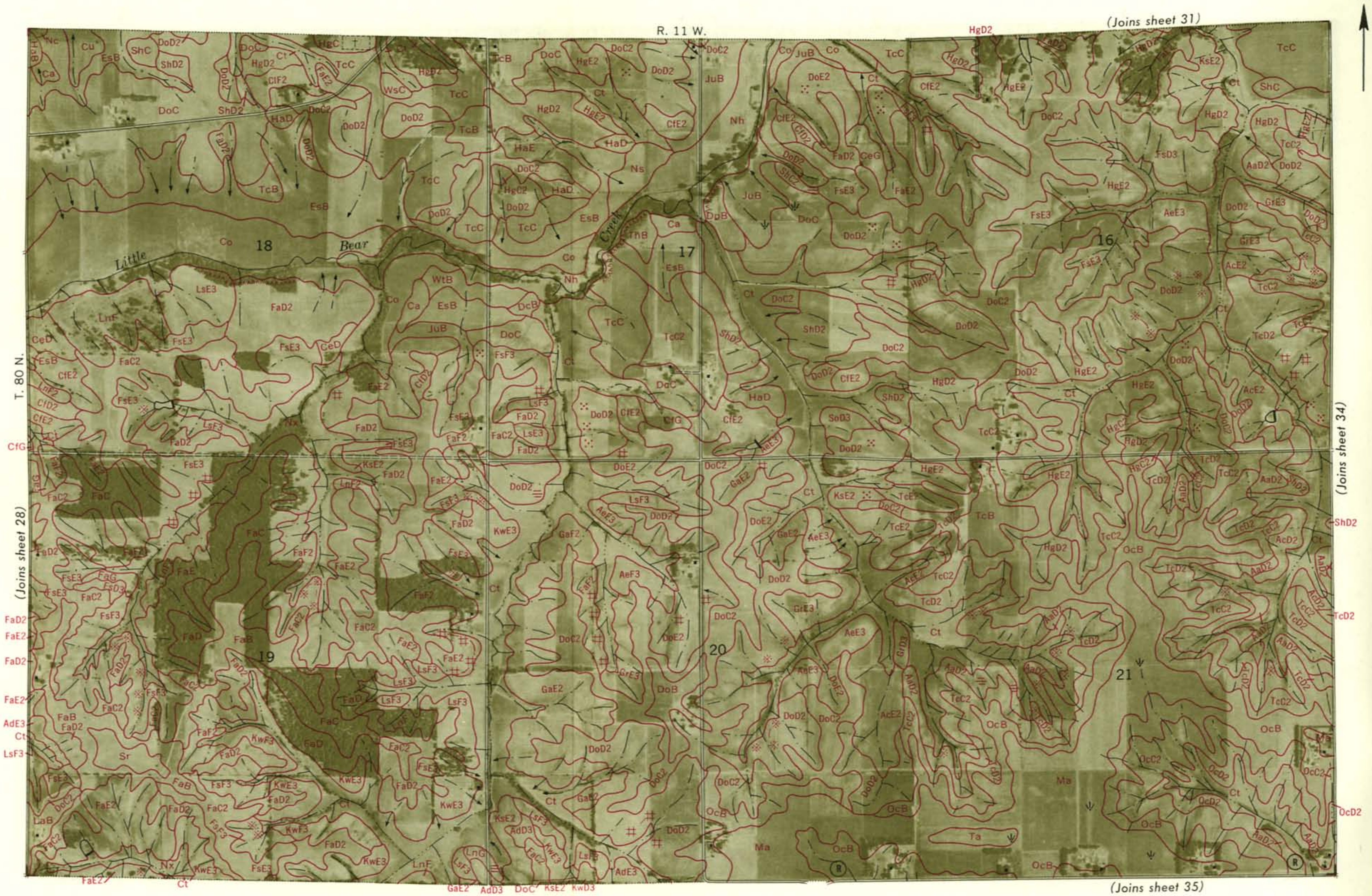
(Joins sheet 34)
BIG BEAR CREEK


N
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R. 11 W.
T. 80 N.
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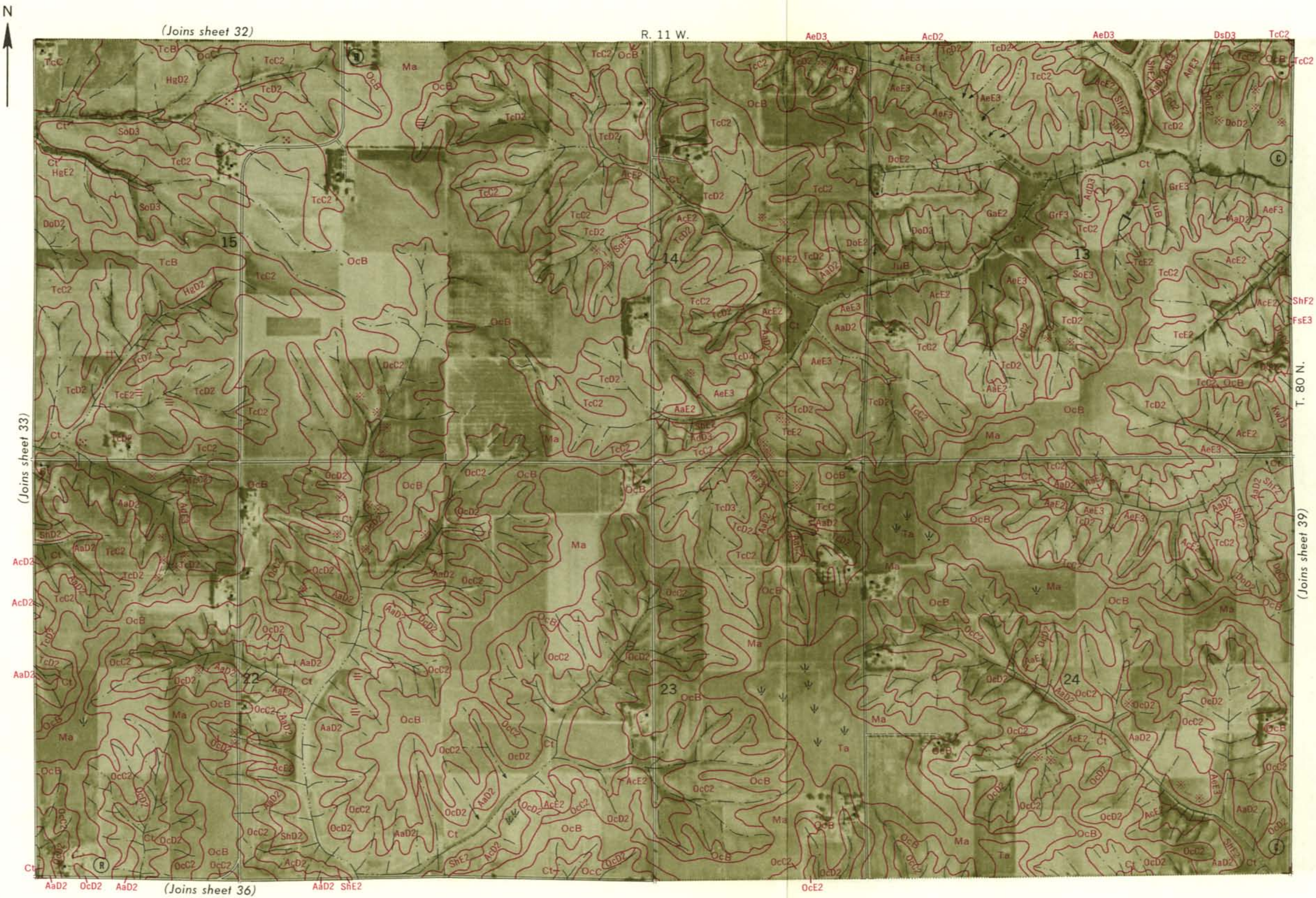
(Joins sheet 34)
(Joins sheet 35)
Little
Bear
Creek
18
17
16
19
20
21


N
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R. 11 W.
T. 80 N.
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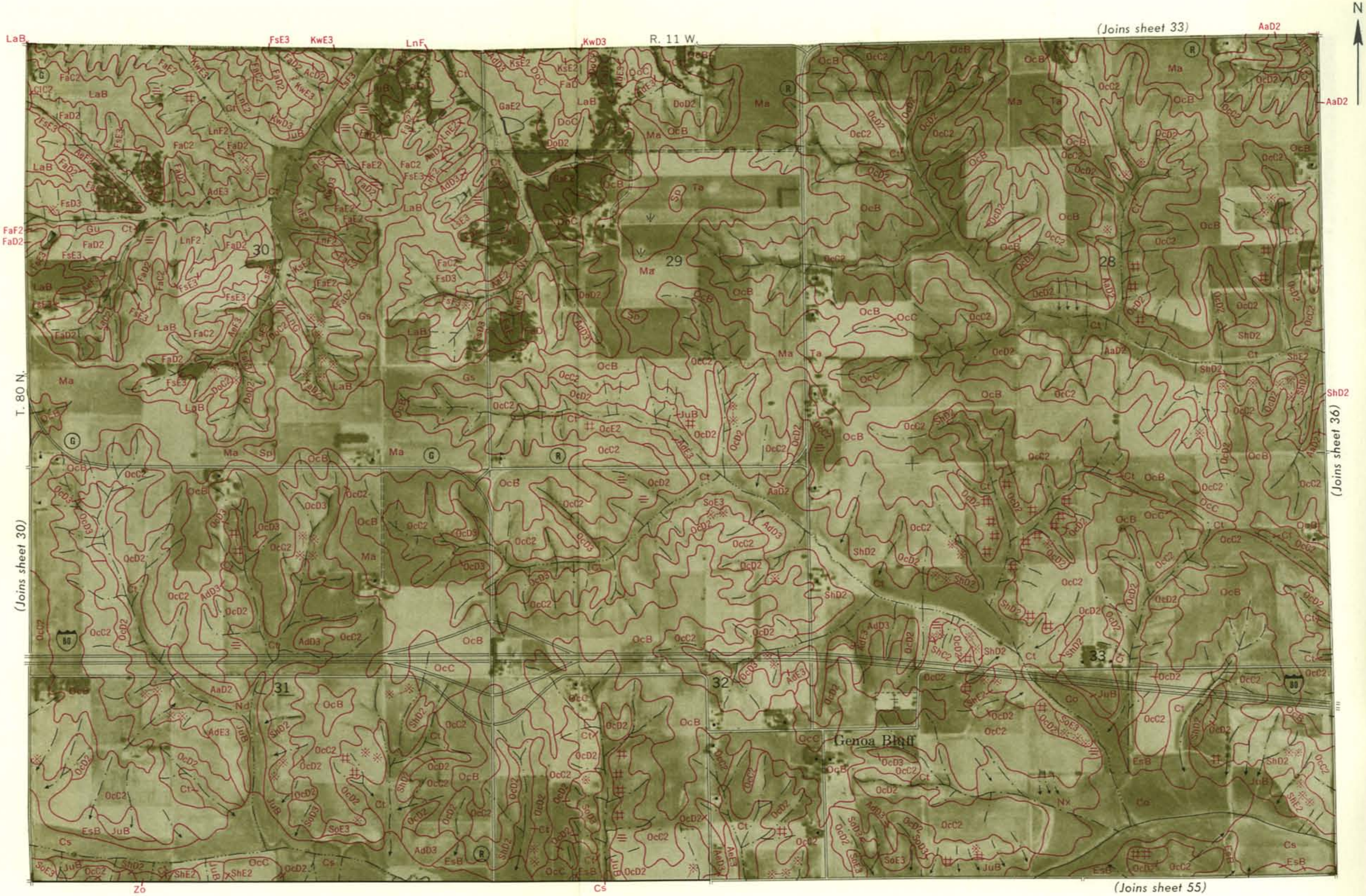
(Joins sheet 39)
(Joins sheet 36)
15
14
13
22
23
24


N
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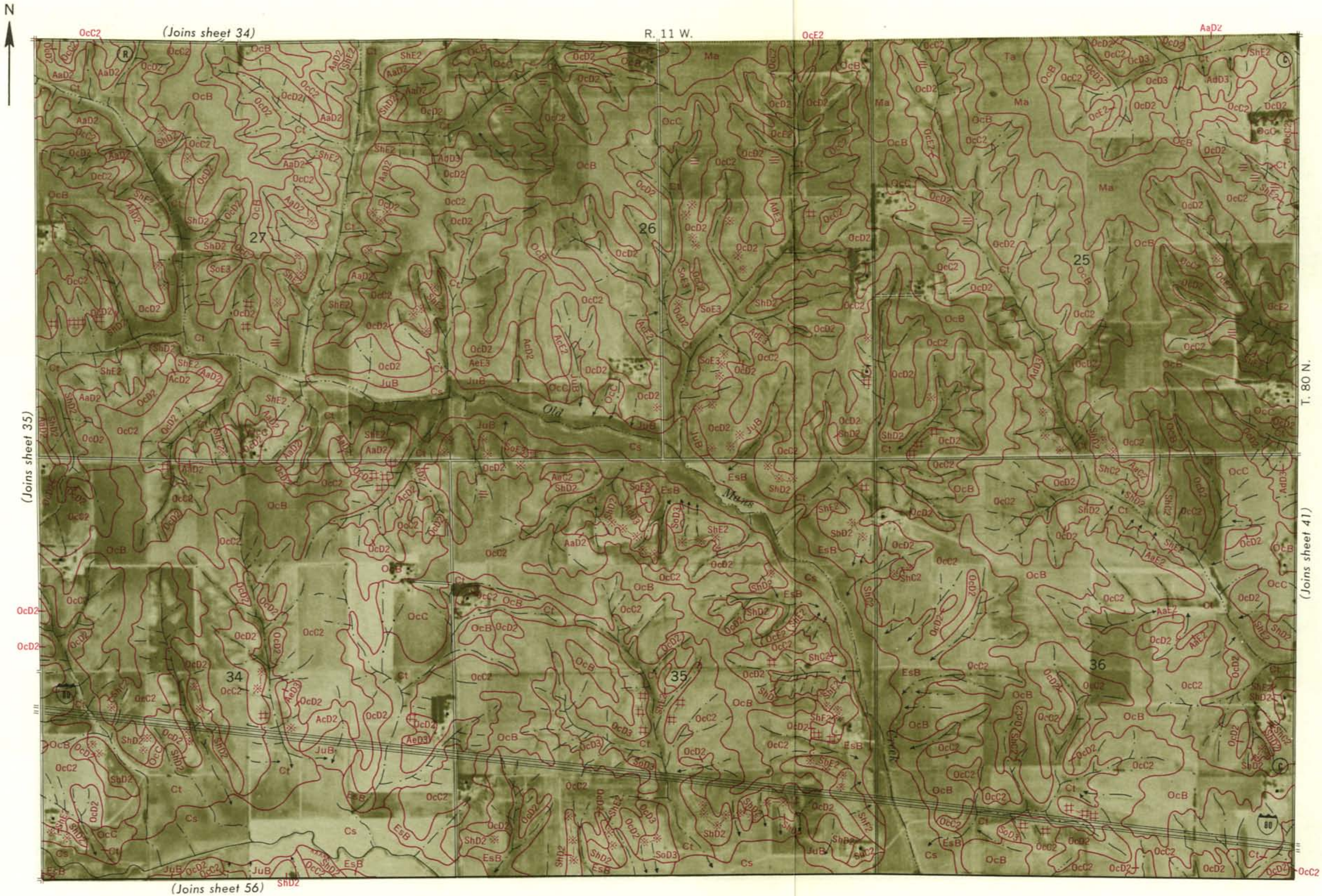
R. 11 W.
T. 80 N.
(Joins sheet 30)
(Joins sheet 36)
(Joins sheet 55)
Genoa Bluff
28
29
30
31
32
33
LaB
FsE3
KwE3
LnF
KwD3
AaD2
FaF2
FaD2
ShD2
Zo
Cs


N
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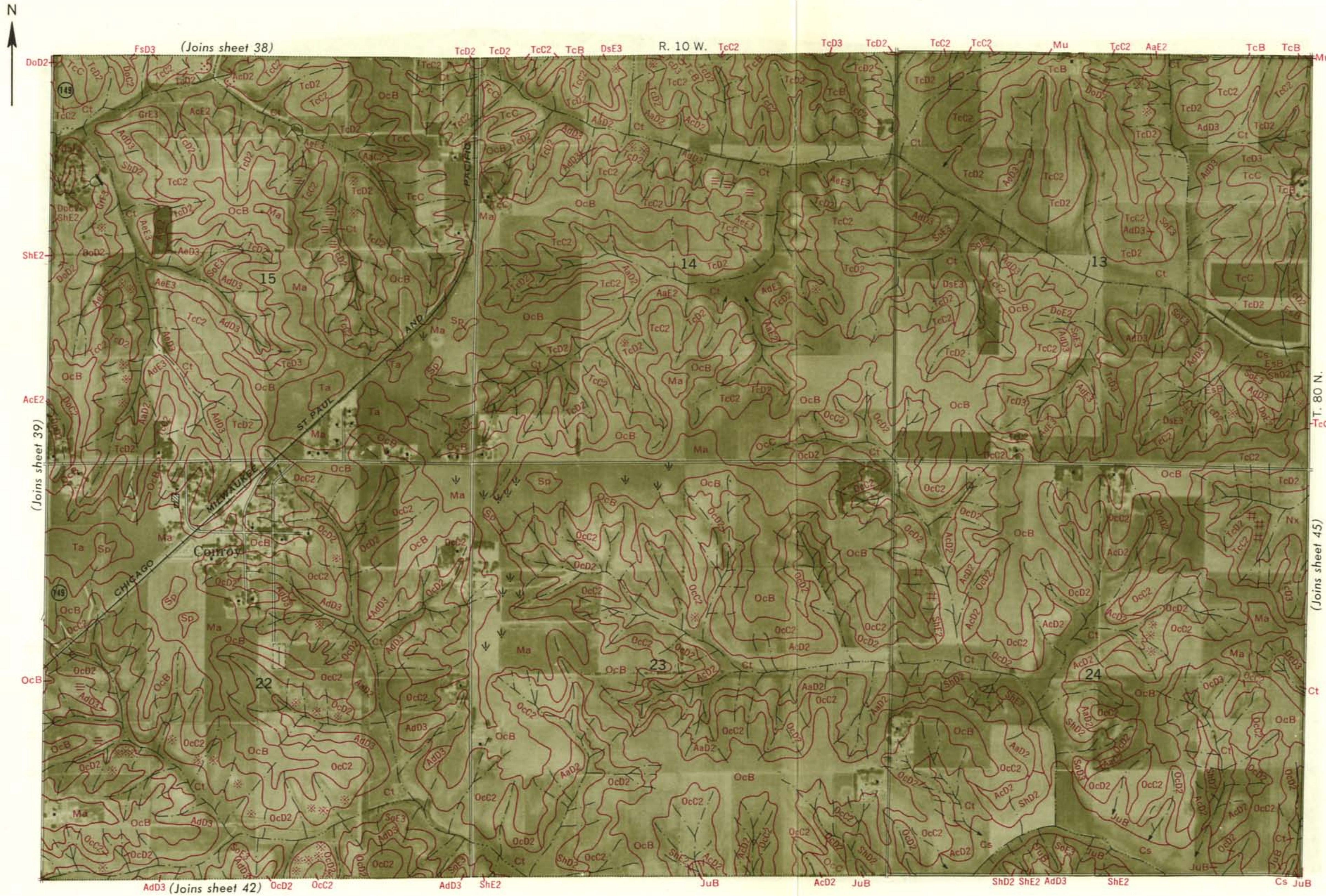
R. 11 W.
T. 80 N.
(Joins sheet 35)
(Joins sheet 41)
(Joins sheet 56)
27
26
25
34
35
36
Old Mans Creek

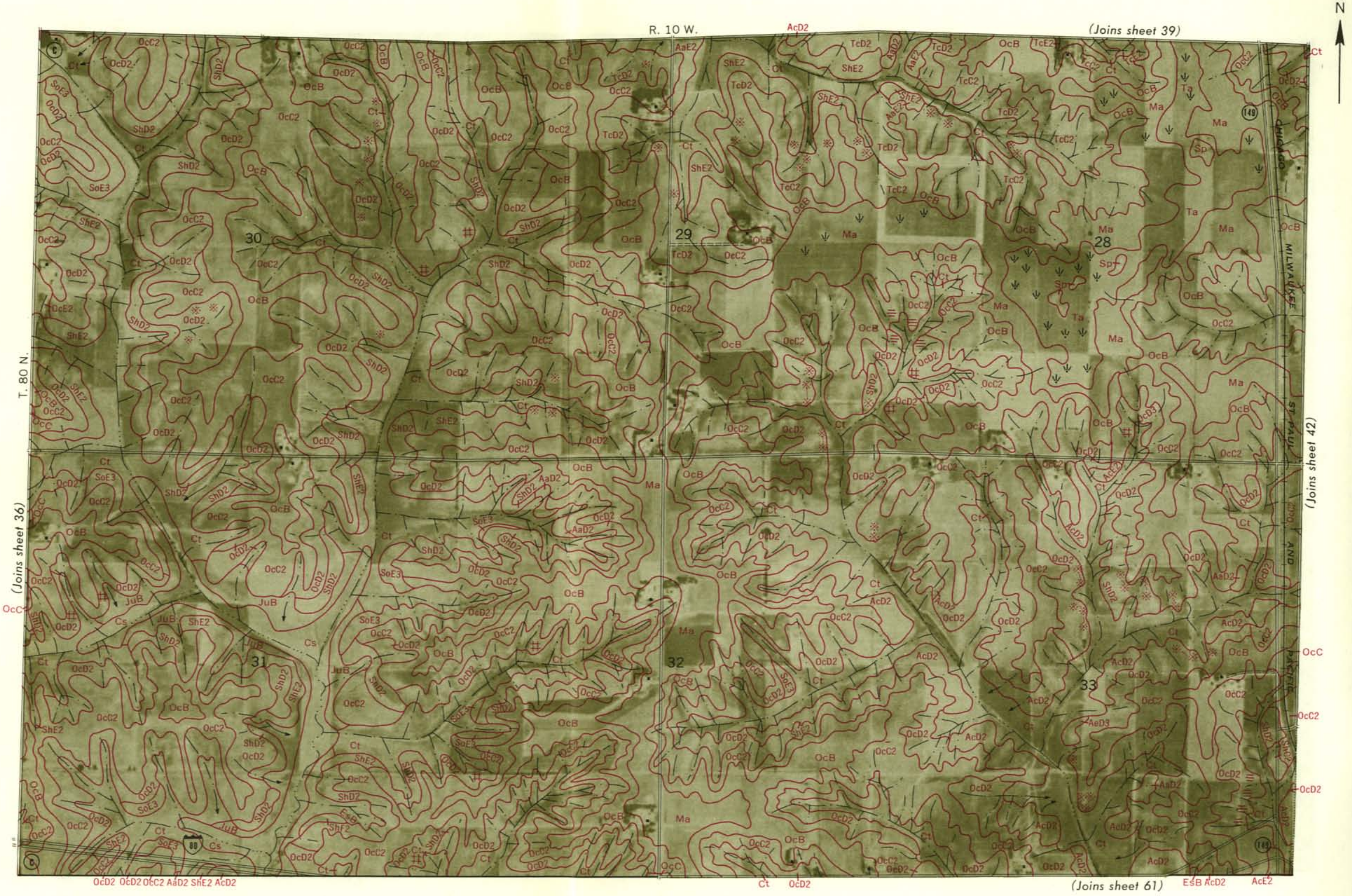

N
R. 10 W.
(Joins sheet 17)
T. 80 N.
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 39)
6
5
4
7
8
9


N
(Joins sheet 18)
R. 10 W.
(Joins sheet 37)
(Joins sheet 43)
T. 80 N.
(Joins sheet 40)
South Amana
CHICAGO
MILWAUKEE
ST PAUL
AND
PACIFIC
1
2
3
10
11
12

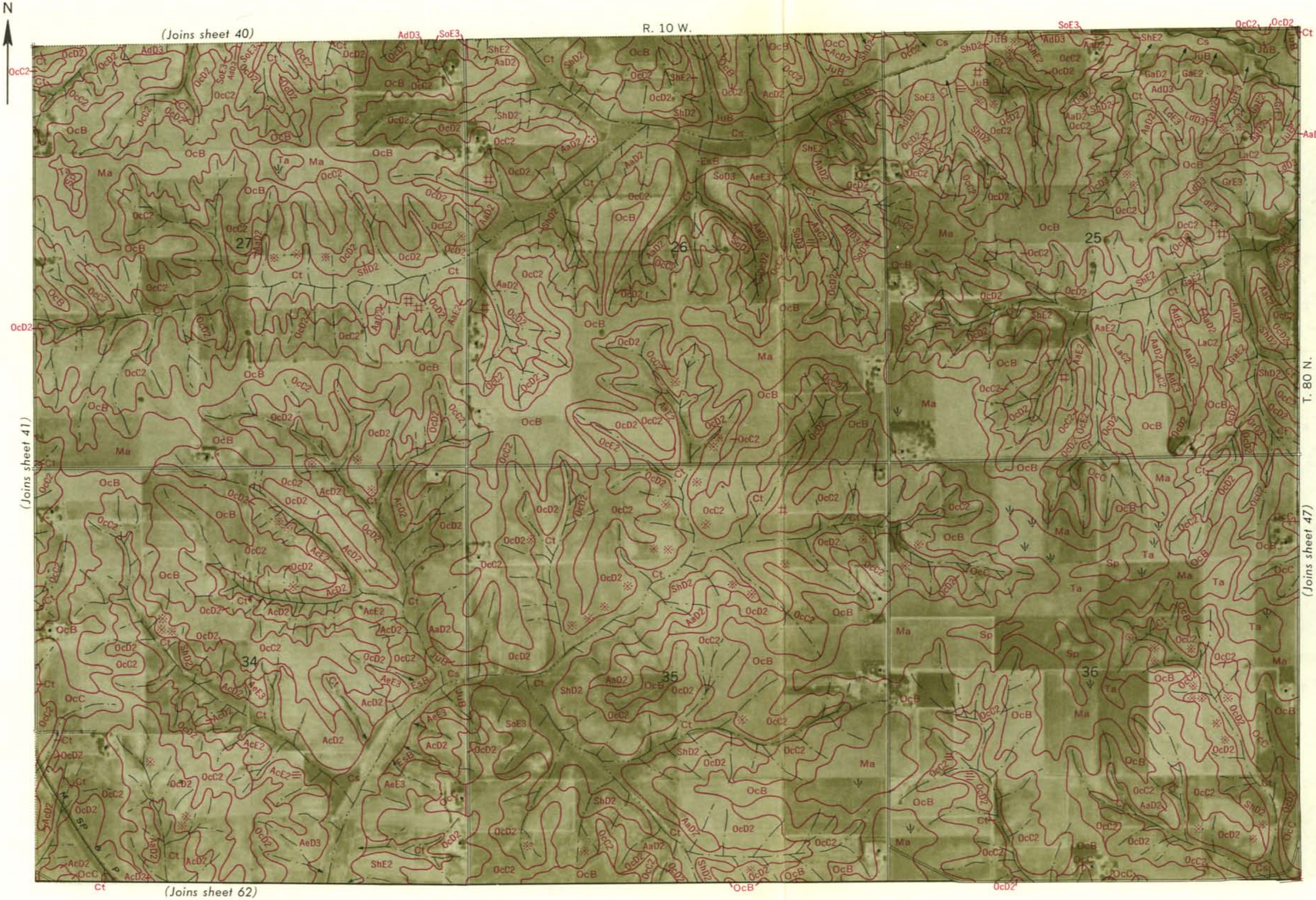

N
R. 10 W.
(Joins sheet 37)
T. 80 N.
(Joins sheet 34)
(Joins sheet 40)
(Joins sheet 41)
18
17
16
19
20
21


N
(Joins sheet 2)
R. 12 W.
(Joins sheet 3)
(Joins sheet 9)
T. 81 N.
(Joins sheet 6)
Koszta
Honey Creek
13
14
15
22
23
24
212

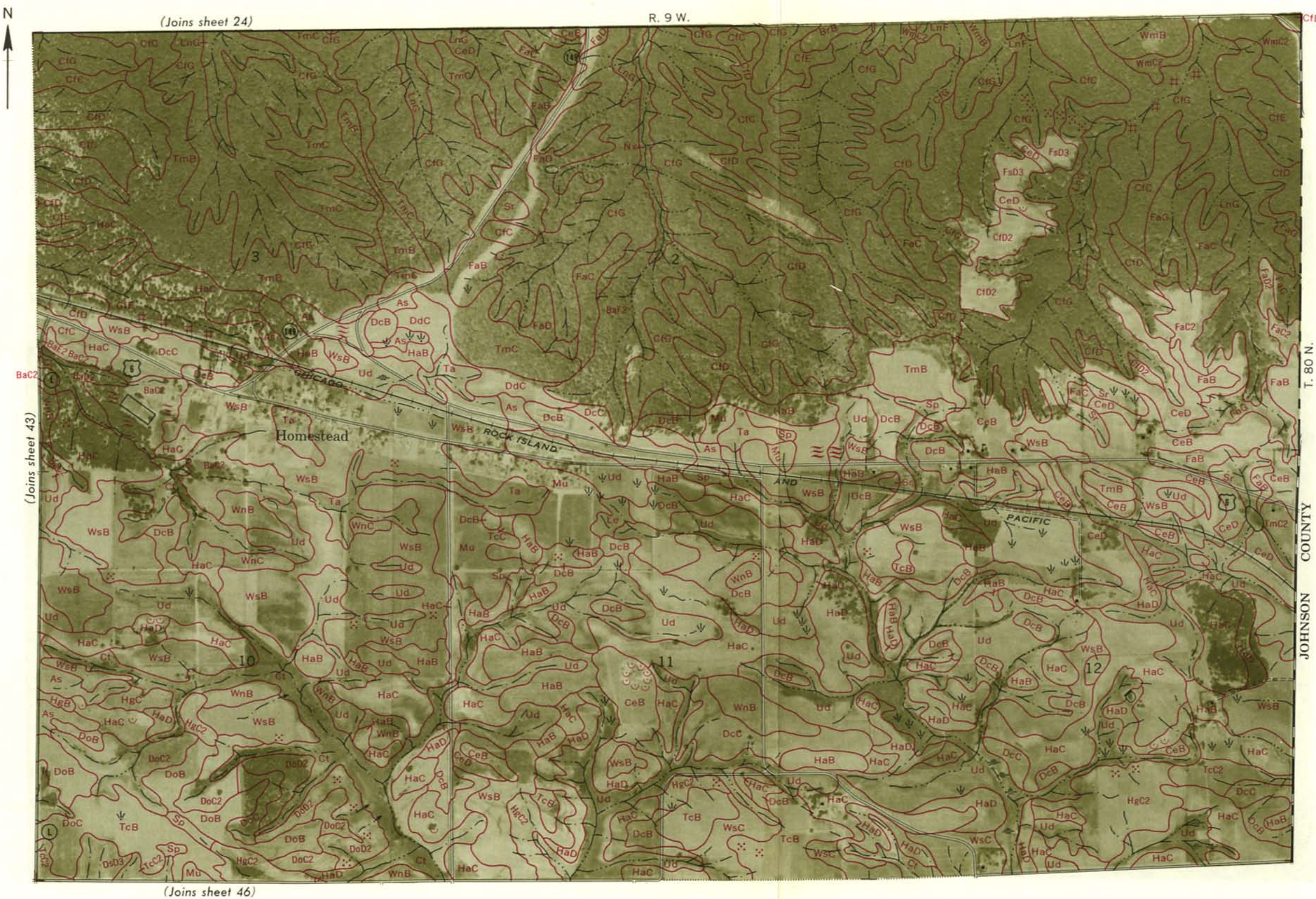

N
(Joins sheet 38)
R. 10 W.
(Joins sheet 39)
T. 80 N.
(Joins sheet 45)
(Joins sheet 42)
CHICAGO
MILWAUKEE
ST PAUL
AND
PACIFIC
Conroy
149
15
14
13
22
23
24


N
R. 10 W.
(Joins sheet 39)
T. 80 N.
(Joins sheet 36)
(Joins sheet 42)
(Joins sheet 61)
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
30
29
28
31
32
33
149
80

IOWA COUNTY, IOWA — SHEET NUMBER 42




R. 9 W.
(Joins sheet 23)
N
T. 80 N.
(Joins sheet 38)
(Joins sheet 44)
(Joins sheet 45)
CHICAGO ROCK ISLAND AND PACIFIC
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
6
5
4
7
8
9


N
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JOHNSON COUNTY
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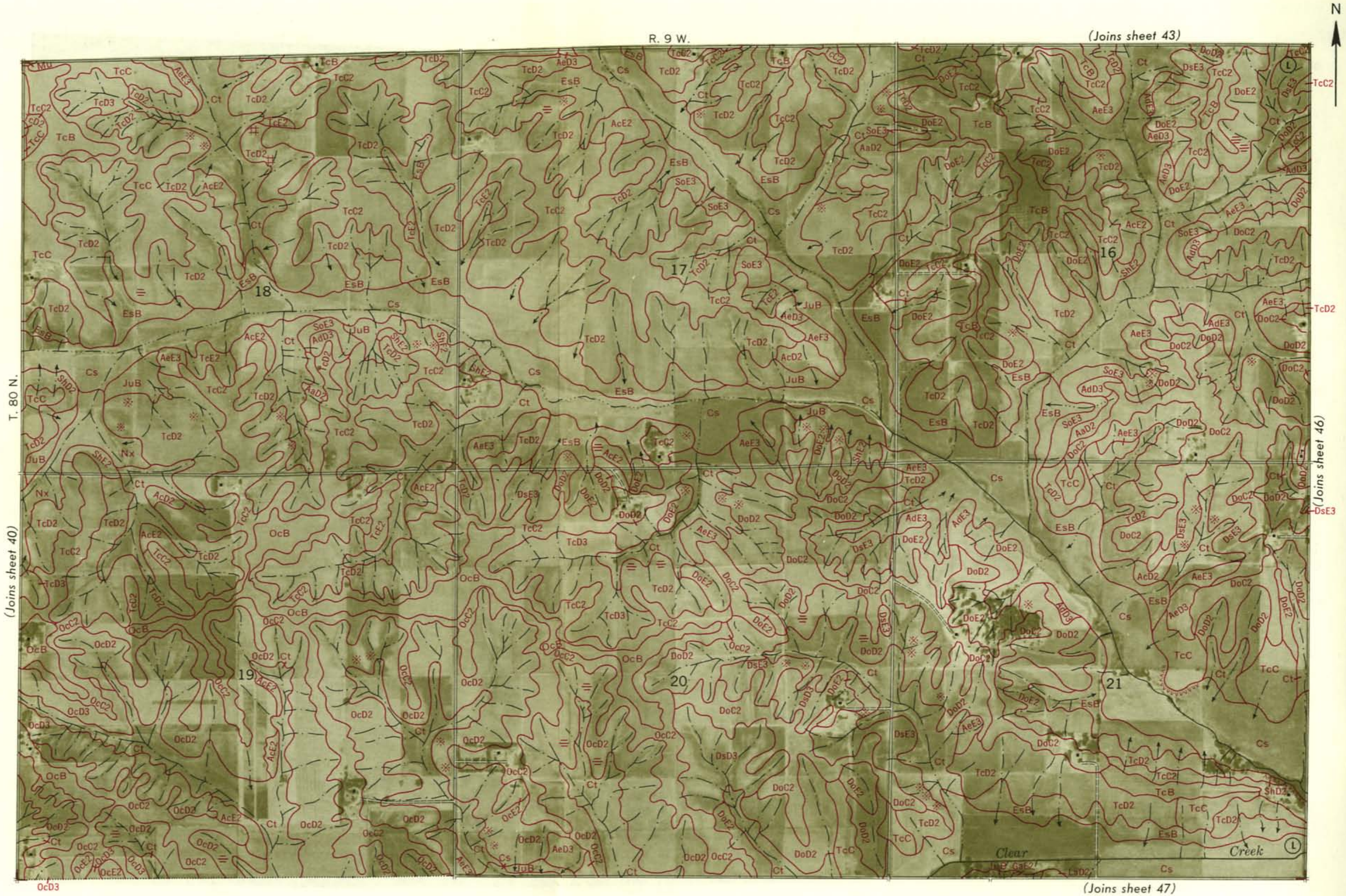
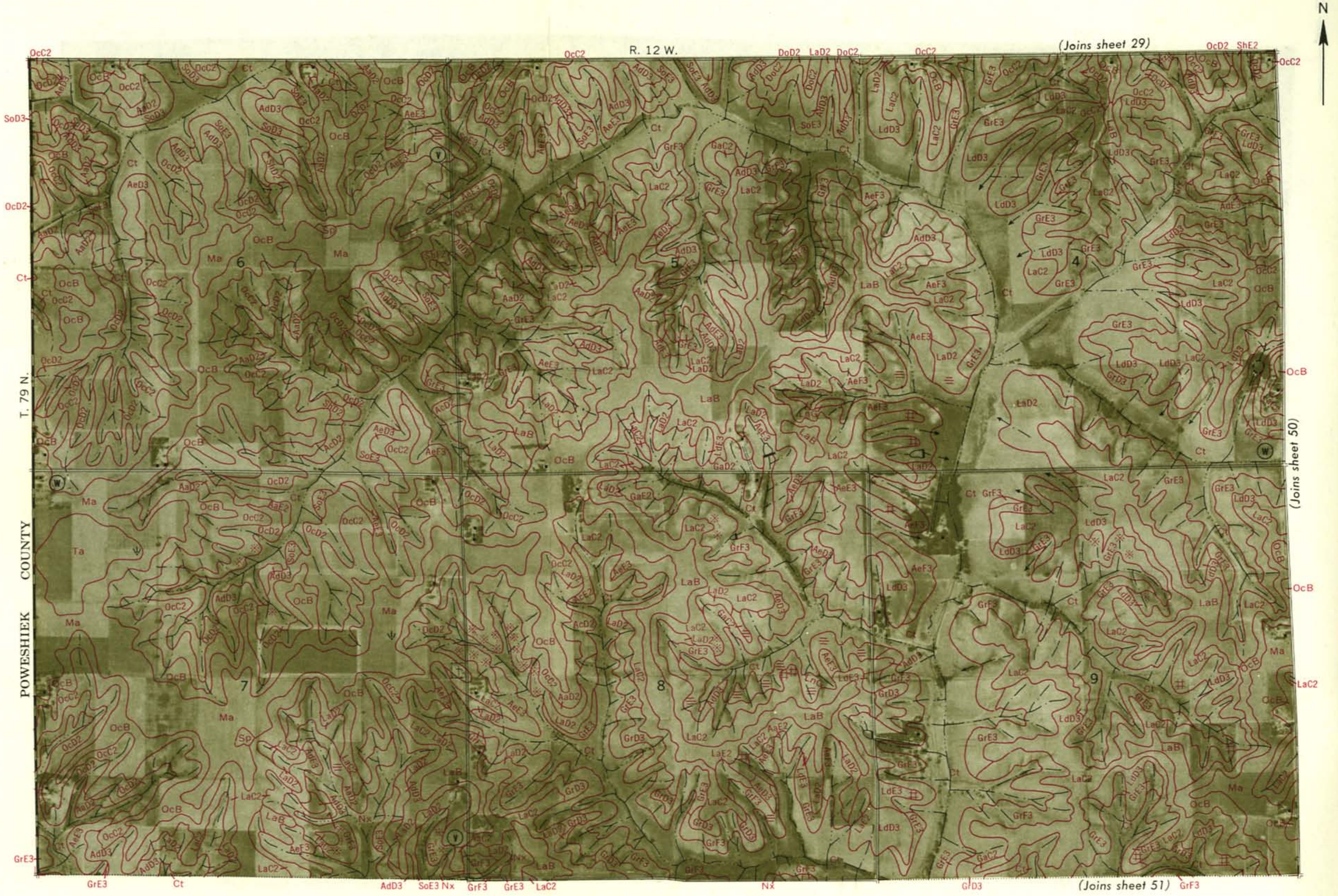
Homestead
CHICAGO
ROCK ISLAND
AND
PACIFIC


N
R. 9 W.
(Joins sheet 43)
T. 80 N.
(Joins sheet 40)
(Joins sheet 46)
(Joins sheet 47)
16
17
18
19
20
21
Clear
Creek


N
(Joins sheet 44)
R. 9 W.
(Joins sheet 45)
T. 80 N.
JOHNSON COUNTY
(Joins sheet 48)
15
14
13
22
23
24
Clear Creek


R. 9 W.
(Joins sheet 45)
N
T. 80 N.
(Joins sheet 42)
(Joins sheet 48)
(Joins sheet 67)
Clear
Creek
30
29
28
31
32
33


N
(Joins sheet 46)
R. 9 W.
T. 80 N.
JOHNSON COUNTY
(Joins sheet 47)
(Joins sheet 68)
Clear
Creek
CANAL
27
26
25
34
35
36
80
DoC2
Ct
DsE3
DoD2
LaB
LaC2
LaD2
ClE2
GaD2
GaE2
OcC2
OcB
OcD2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(Joins sheet 51)
T. 79 N.
POWESHIEK COUNTY
4
5
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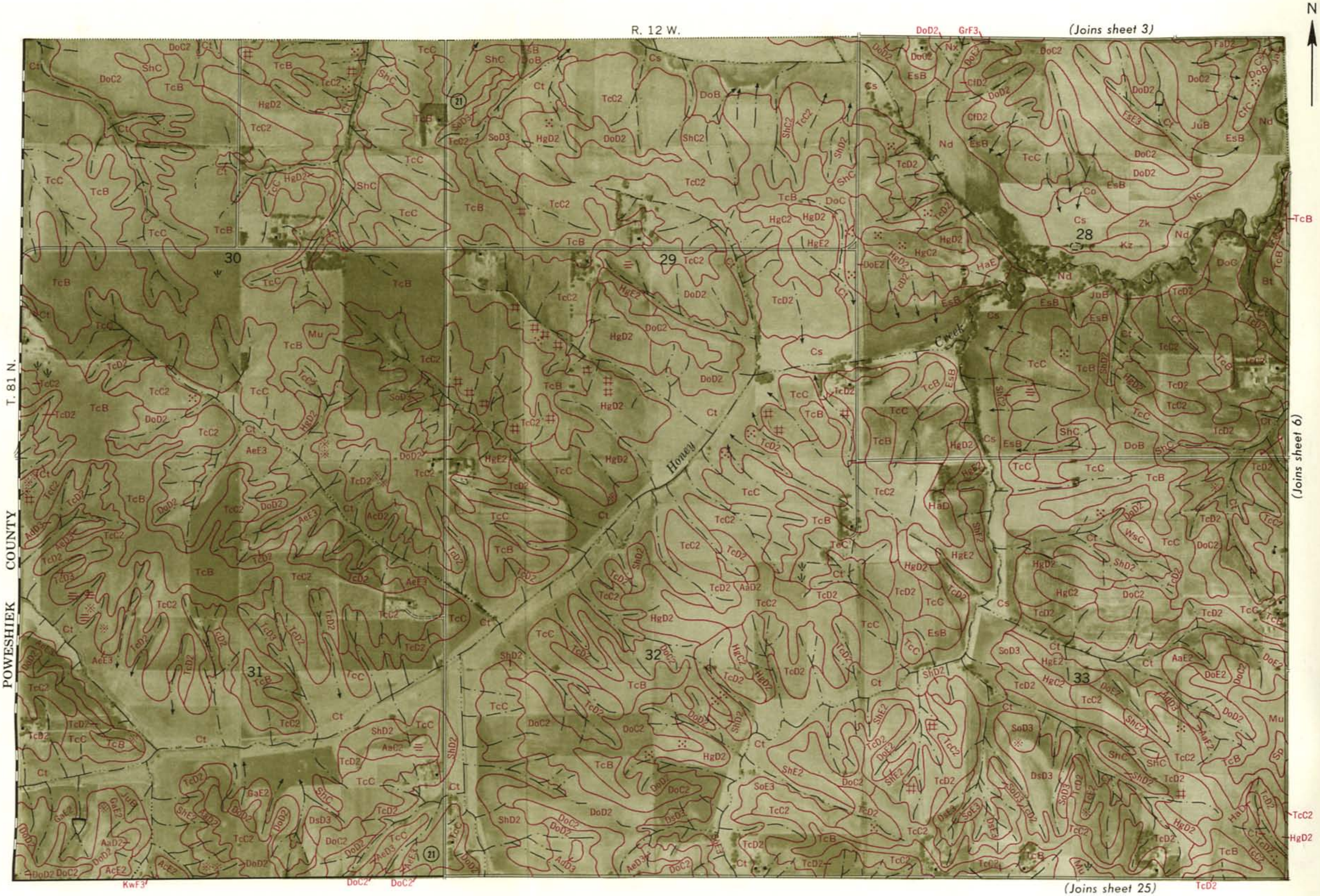
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N
T. 81 N.
POWESHIEK COUNTY
(Joins sheet 6)
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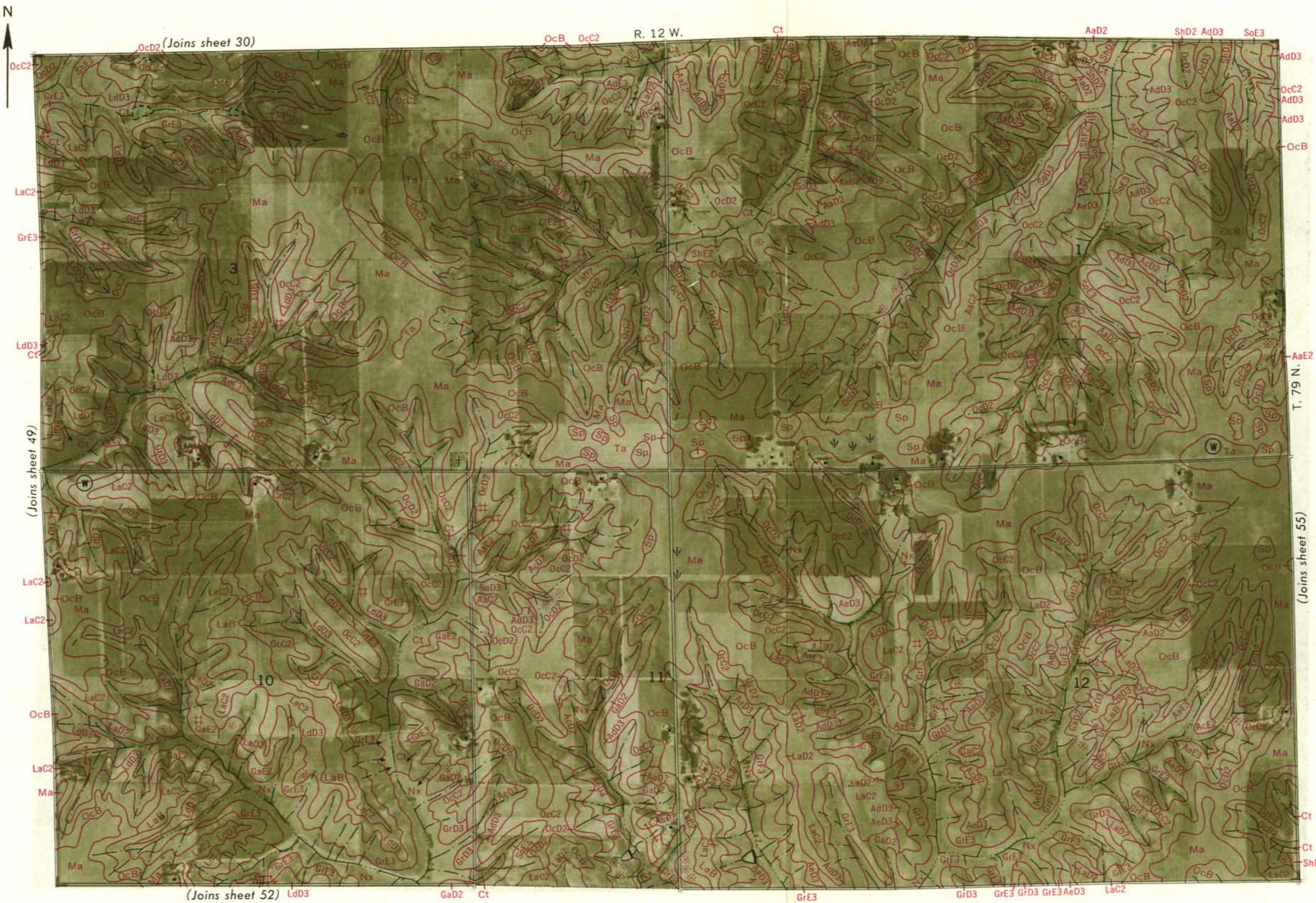
30
29
28
31
32
33
Honey
Creek
21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T. 79 N.
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(Joins sheet 55)
(Joins sheet 52)
3
2
1
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11
12


N
R. 12 W.
(Joins sheet 49)
(Joins sheet 52)
(Joins sheet 53)
T. 79 N.
POWESHIEK COUNTY
CANAL
16
17
18
19
20
21

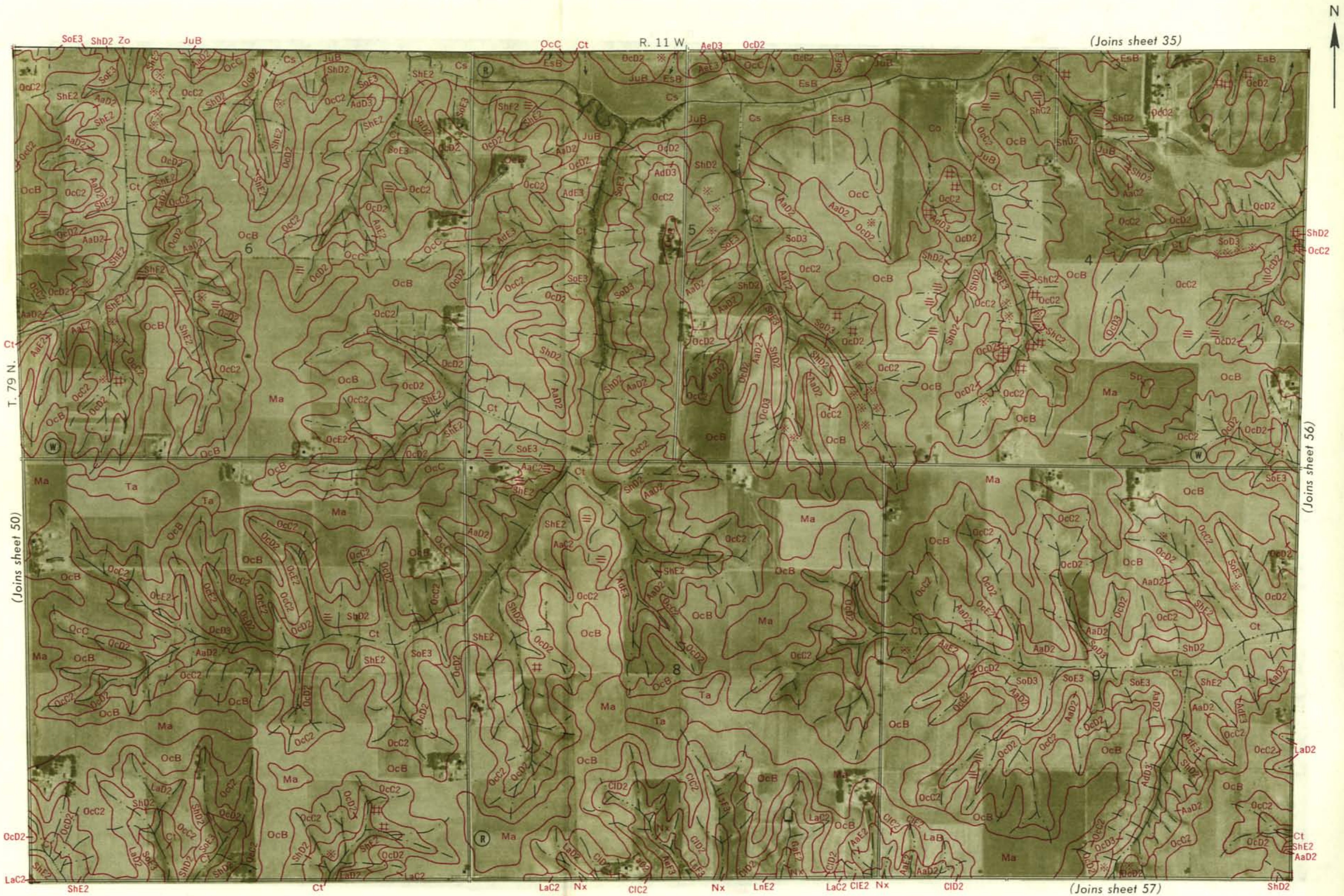
52


N
(Joins sheet 50)
R. 12 W.
T. 79 N.
(Joins sheet 51)
(Joins sheet 57)
(Joins sheet 54)
15
14
13
22
23
24
Devils
Run


N
(Joins sheet 51)
(Joins sheet 54)
(Joins sheet 73)
T. 79 N.
POWESHIEK COUNTY
CANAL
29
30
28
31
32
33

54


N
(Joins sheet 52)
R. 12 W.
T. 79 N.
(Joins sheet 53)
(Joins sheet 59)
(Joins sheet 74)
27
26
25
34
35
36
River
Devils
Run


N
R. 11 W.
(Joins sheet 35)
T. 79 N.
(Joins sheet 50)
(Joins sheet 56)
(Joins sheet 57)
6
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4
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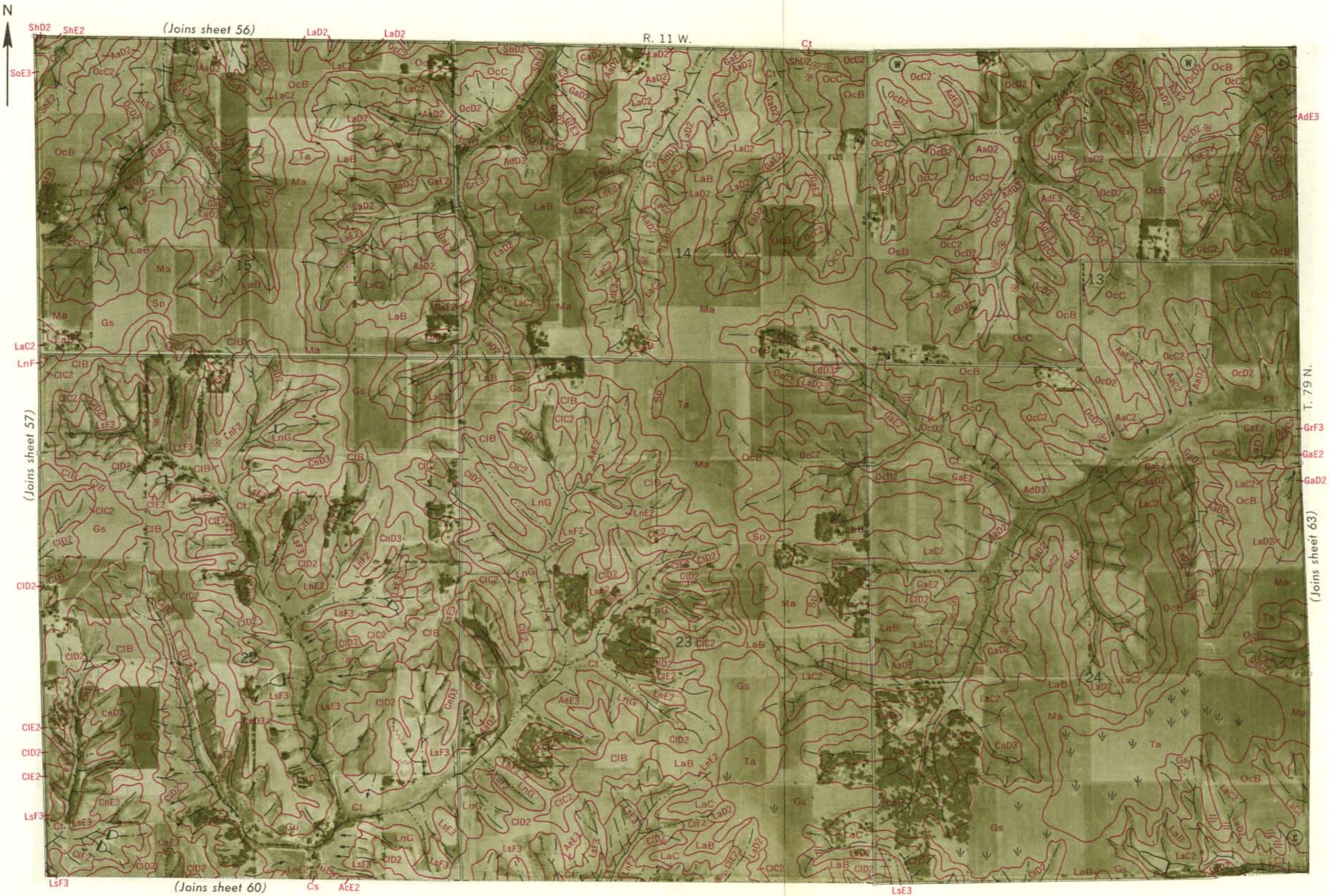
8
9


N
(Joins sheet 36)
R. 11 W.
T. 79 N.
(Joins sheet 55)
(Joins sheet 61)
(Joins sheet 58)
Old Mans Creek
Hog Run
1
2
3
10
11
12


N
(Joins sheet 55)
R. 11 W.
T. 79 N.
(Joins sheet 52)
(Joins sheet 58)
(Joins sheet 59)
16
17
18
19
20
21


N
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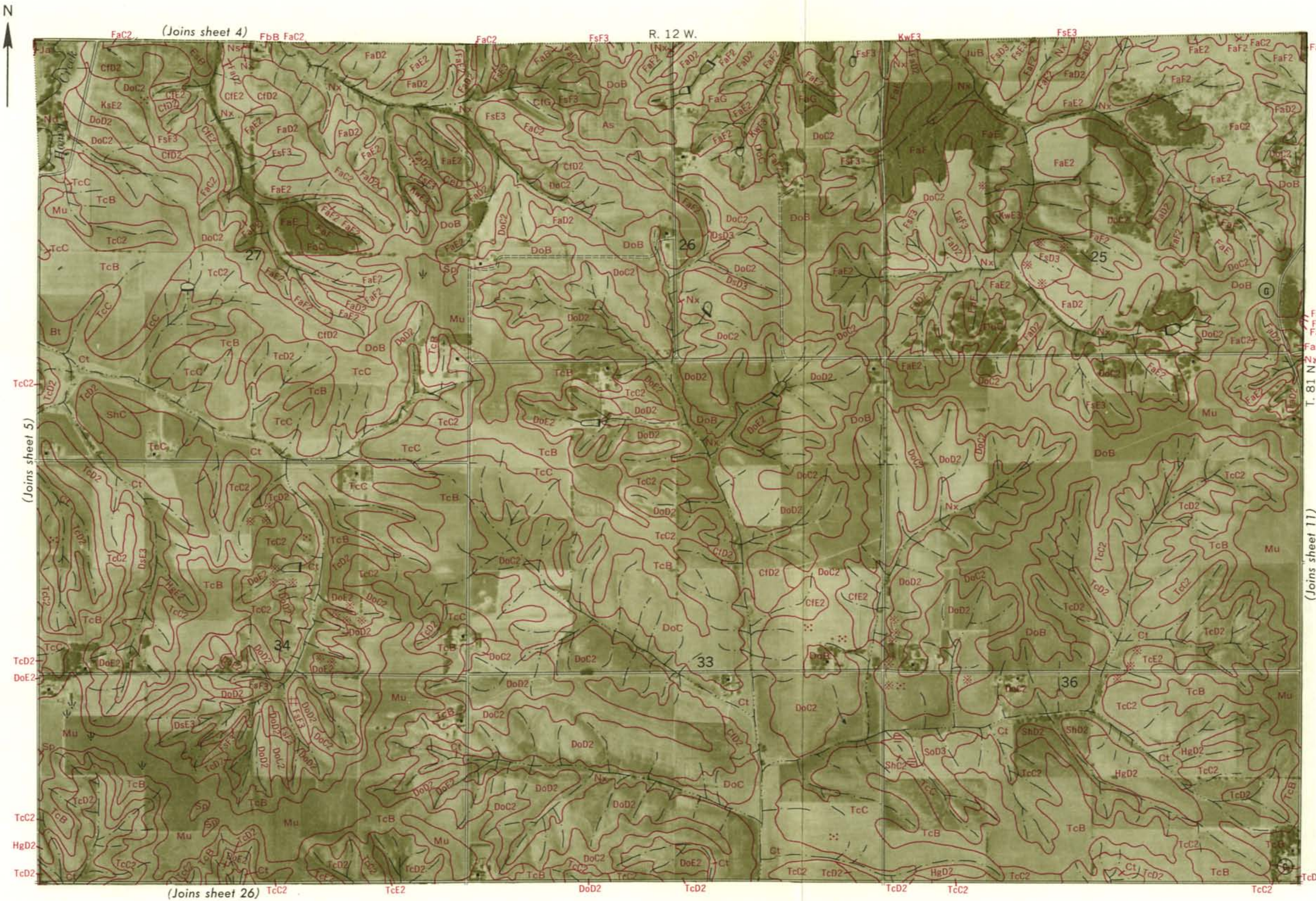
T. 79 N.
(Joins sheet 57)
(Joins sheet 63)
(Joins sheet 60)
15
14
13
22
23
24
ShD2
ShE2
SoE3
LaD2
Ct
AdE3
LaC2
LnF
ClD2
ClE2
LsF3
GrF3
GaE2
GaD2
Cs
AcE2
LsE3
OcB
OcC2
Ma
Ta
Gs
Sp
LaB
ClB
LnG


N
R. 11 W.
(Joins sheet 57)
(Joins sheet 60)
(Joins sheet 79)
(Joins sheet 54)
T. 79 N.
Devils
Run
DEEP
RIVER
28
29
30
31
32
33

6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T. 81 N.
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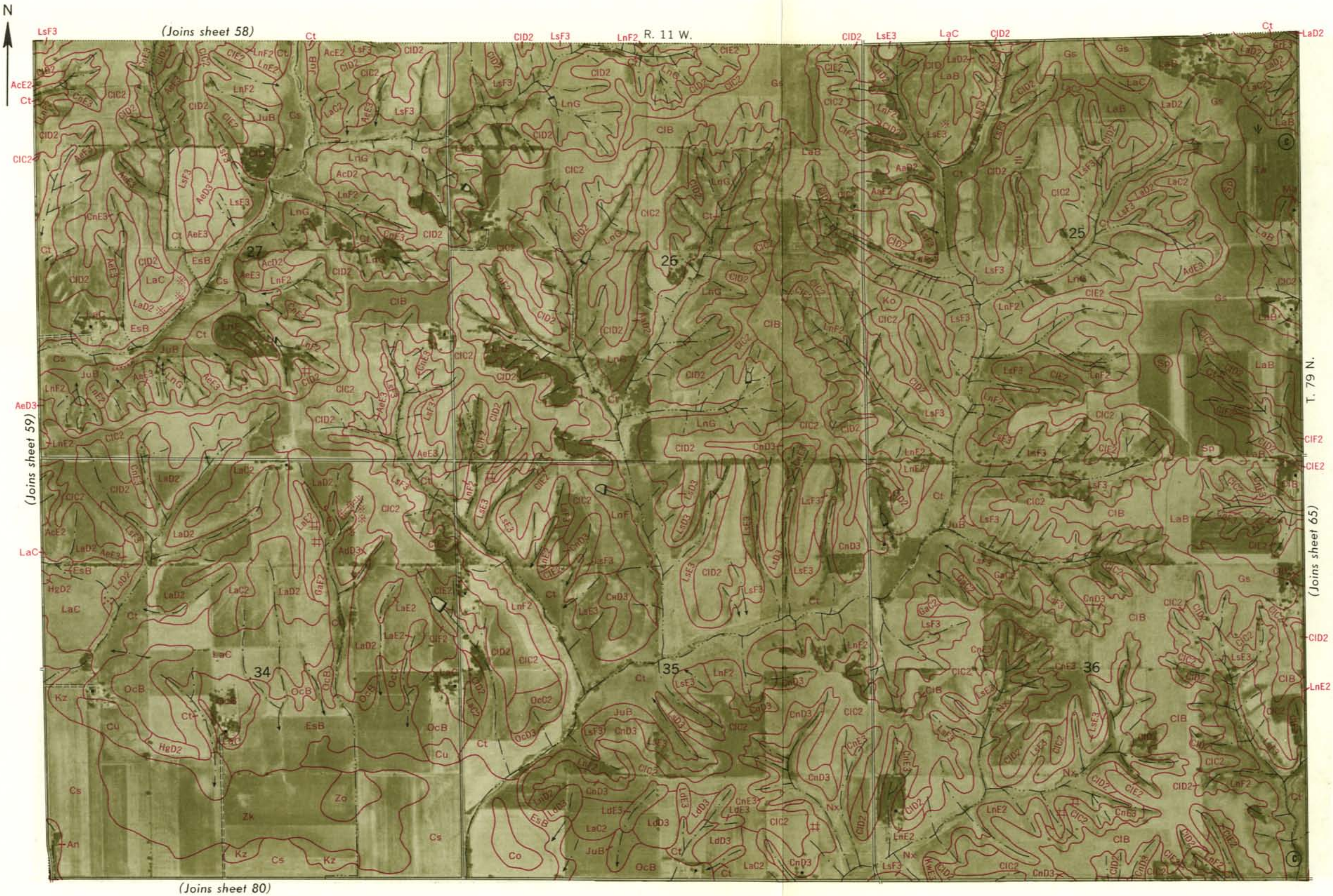
(Joins sheet 11)
(Joins sheet 26)
27
26
25
34
33
36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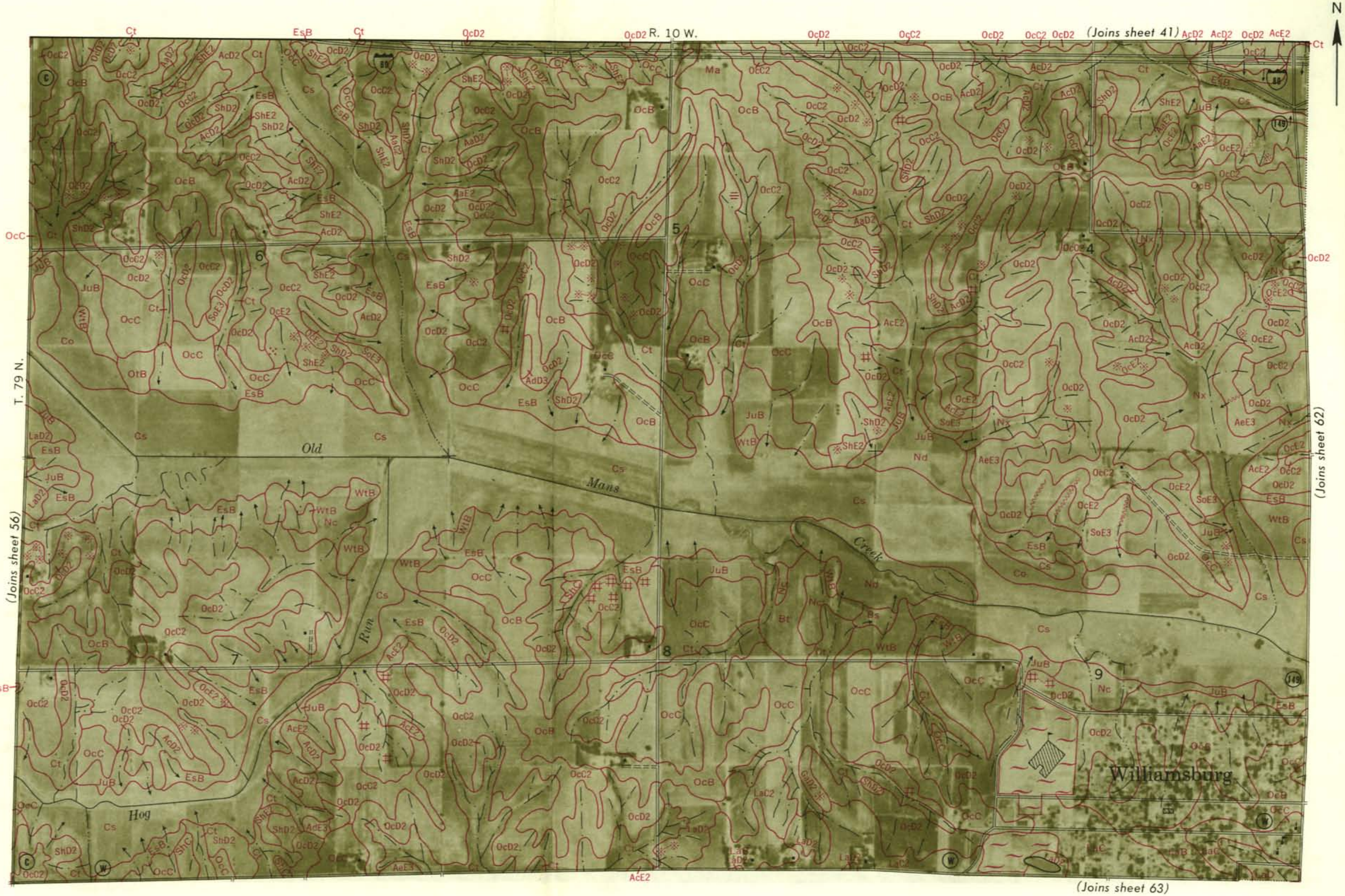
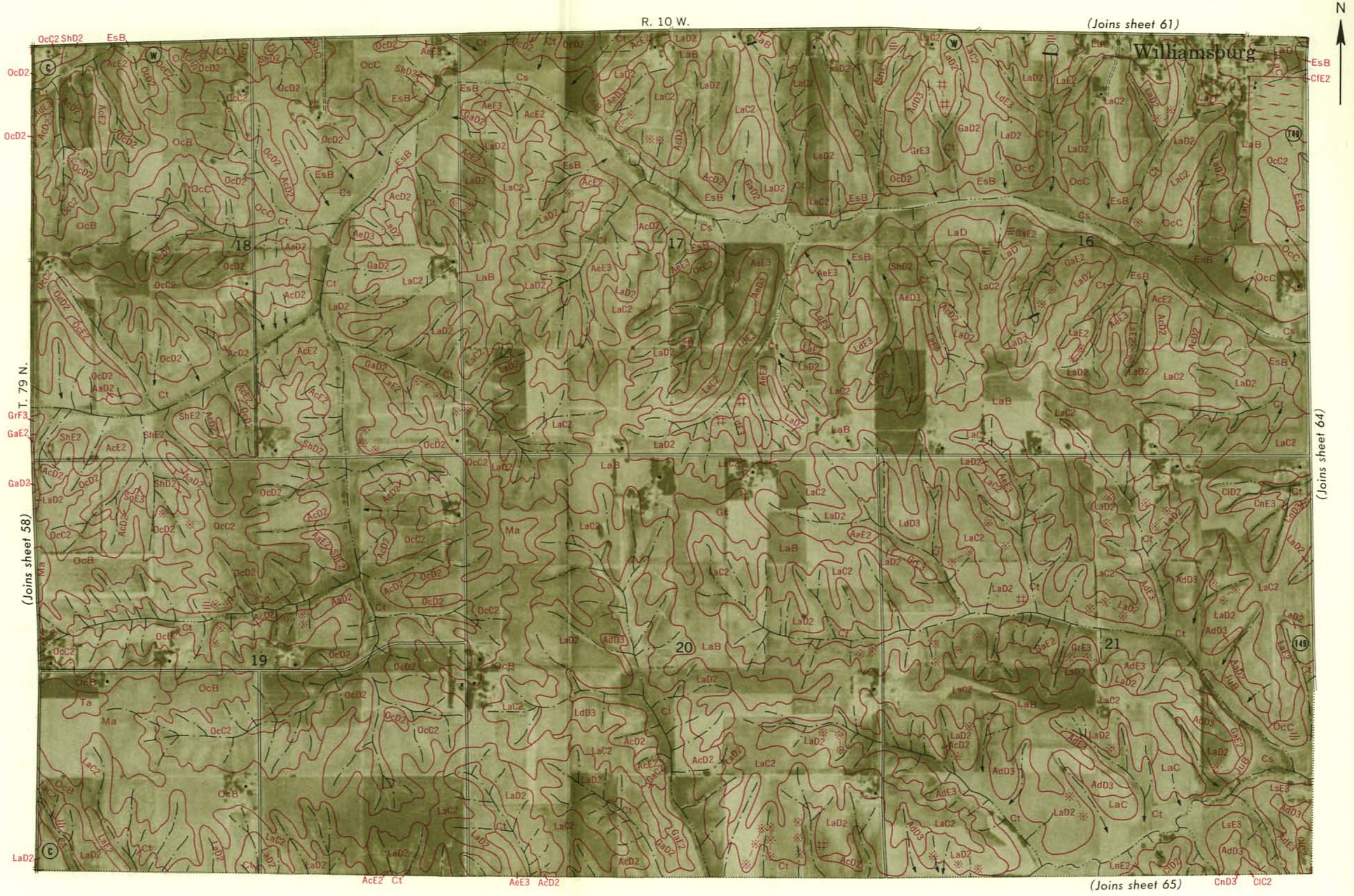
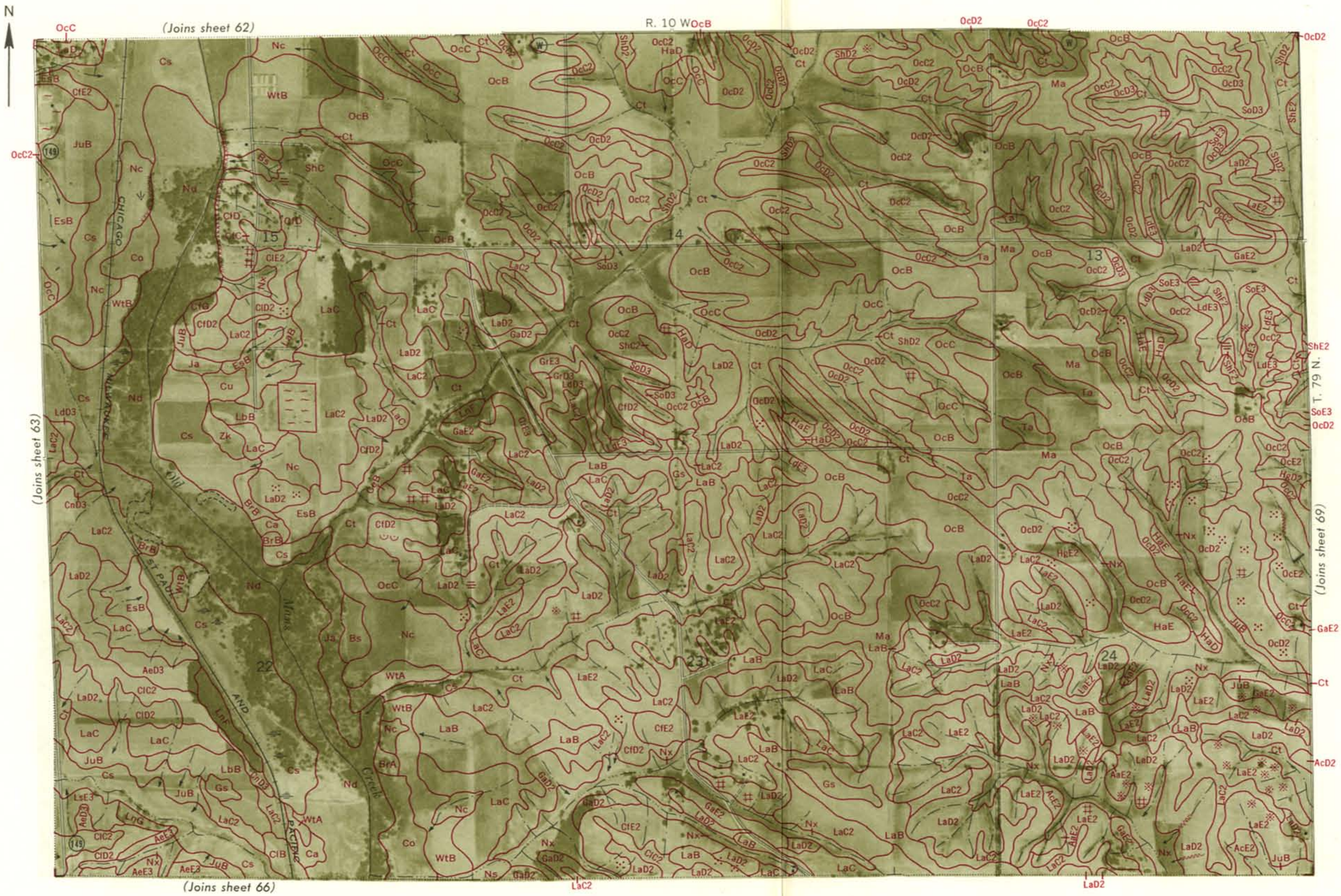
(Joins sheet 59)
T. 79 N.
(Joins sheet 65)
(Joins sheet 80)
27
26
25
34
35
36


N
R. 10 W.
(Joins sheet 41)
(Joins sheet 62)
(Joins sheet 63)
(Joins sheet 56)
T. 79 N.
Old
Mans
Creek
Hog
Run
Williamsburg
5
6
4
7
8
9

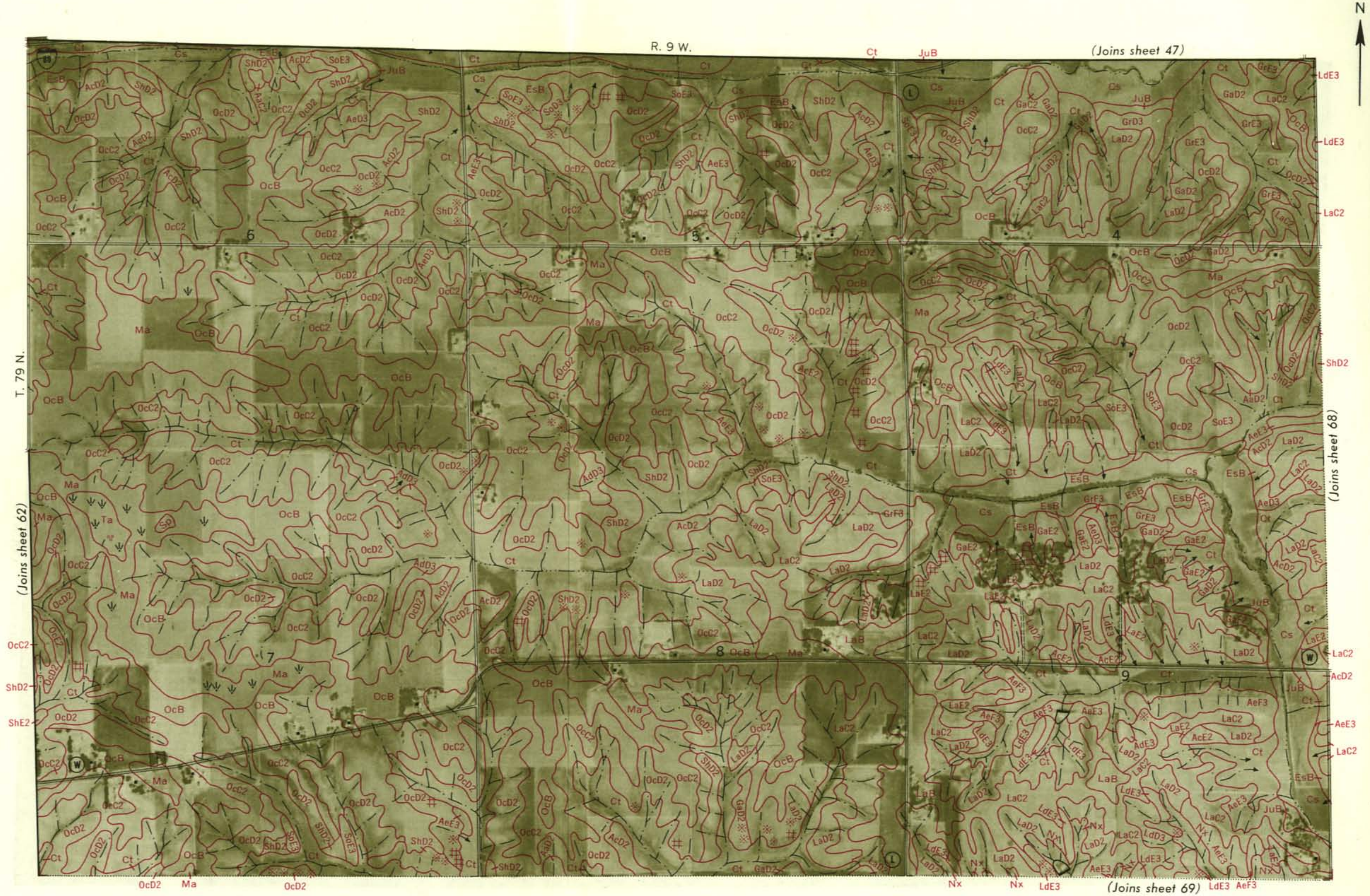

N
(Joins sheet 42)
R. 10 W.
T. 79 N.
(Joins sheet 61)
(Joins sheet 67)
(Joins sheet 64)
Williamsburg
Old Mans Creek
MILWAUKEE
PACIFIC


N
R. 10 W.
(Joins sheet 61)
Williamsburg
T. 79 N.
(Joins sheet 58)
(Joins sheet 64)
(Joins sheet 65)
18
17
16
19
20
21


N
(Joins sheet 62)
R. 10 W.
T. 79 N.
(Joins sheet 63)
(Joins sheet 69)
(Joins sheet 66)
CHICAGO
MILWAUKEE
ST PAUL
AND
PACIFIC
Old
Mans
Creek
13
14
15
22
23
24


N
R. 10 W.
(Joins sheet 63)
(Joins sheet 66)
(Joins sheet 85)
(Joins sheet 60)
T. 79 N.
29
28
30
31
32
33


N
(Joins sheet 64)
R. 10 W.
T. 79 N.
(Joins sheet 65)
(Joins sheet 71)
(Sheet 85) | (Joins sheet 86)
CHICAGO
MILWAUKEE
ST. PAUL
AND
PACIFIC
Old
Mans
Creek
CANAL
27
26
25
34
35
36
149


N
R. 9 W.
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T. 79 N.
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(Joins sheet 68)
(Joins sheet 69)
6
5
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8
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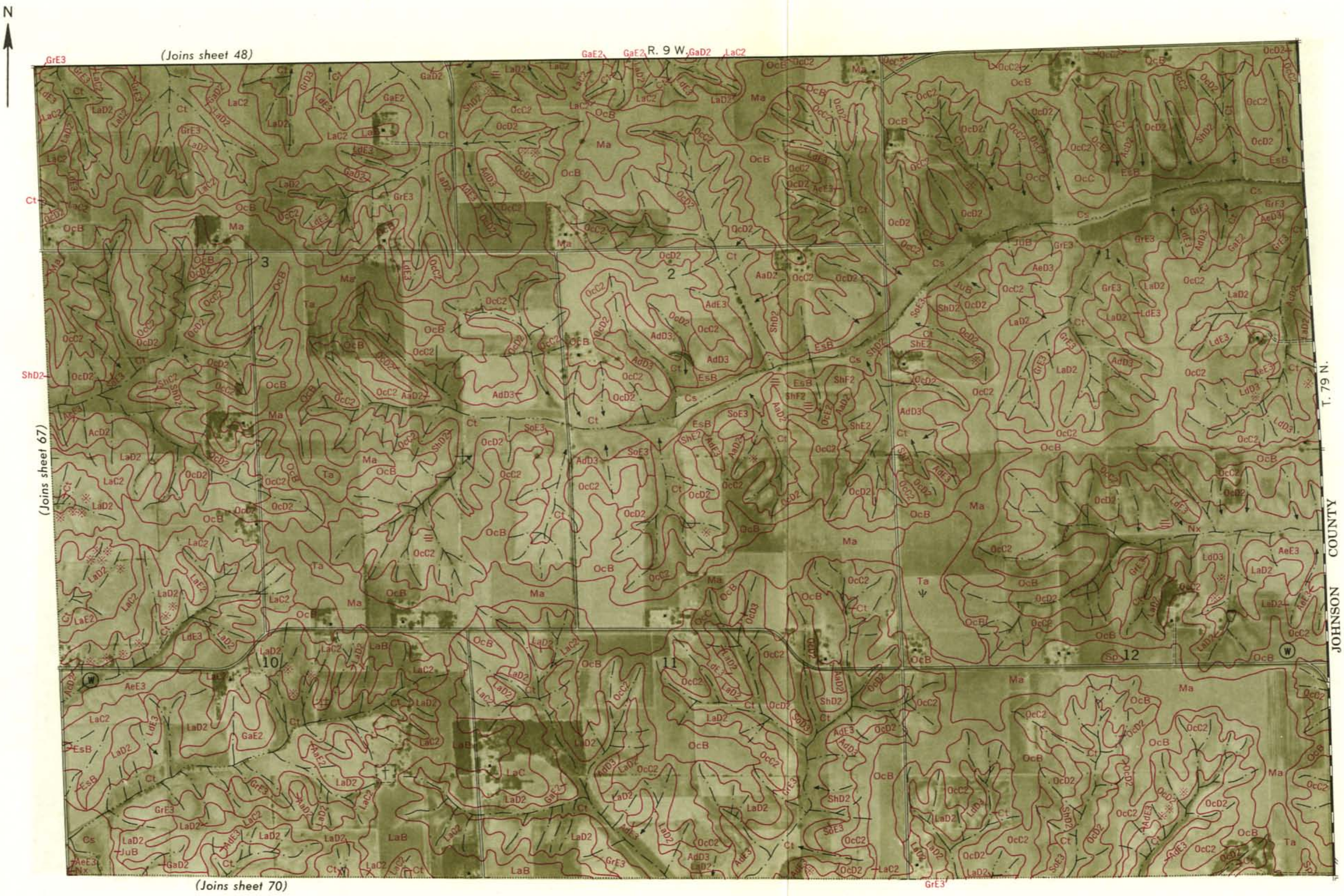
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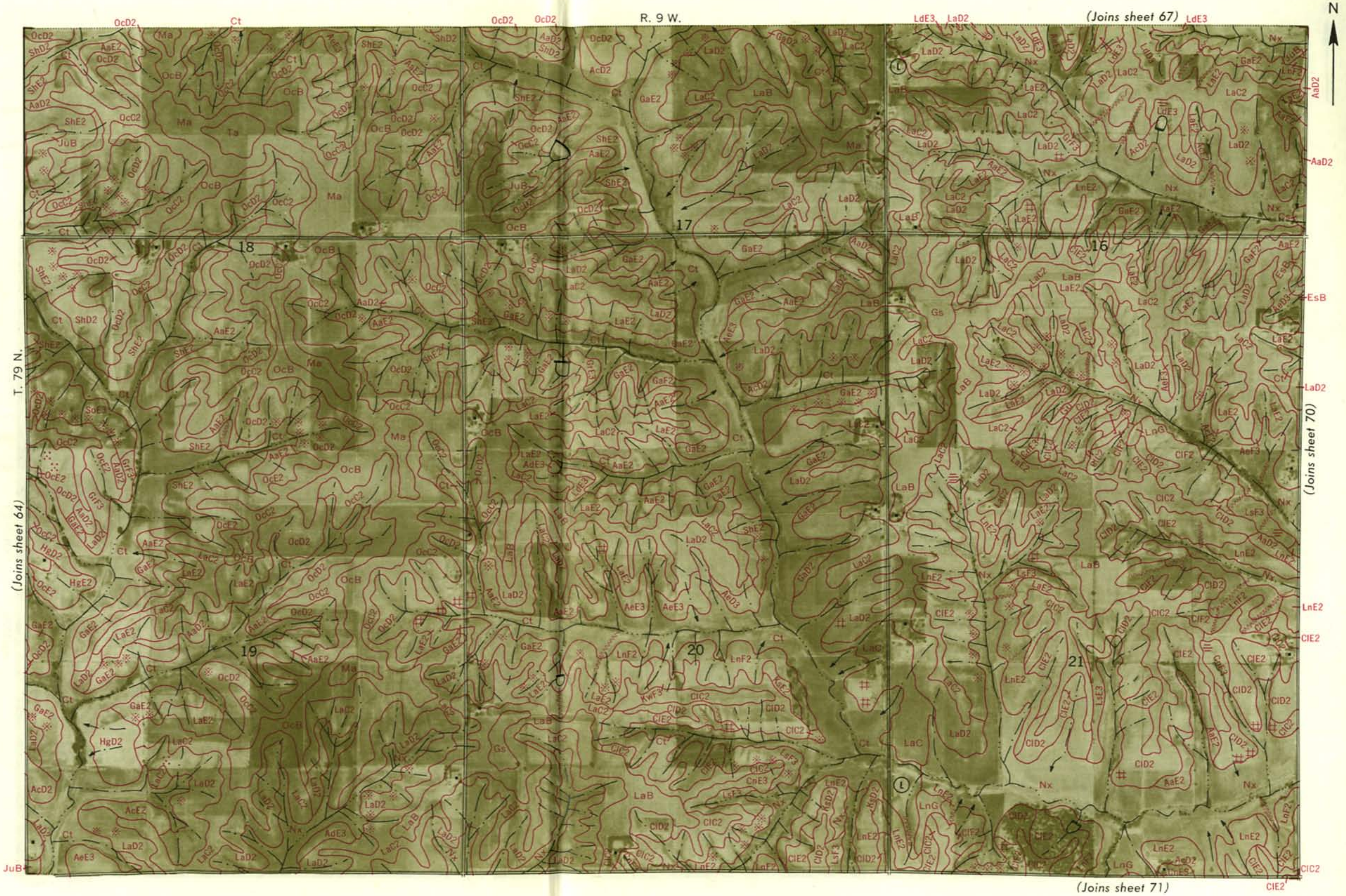
R. 9 W.
(Joins sheet 67)
T. 79 N.
JOHNSON COUNTY
(Joins sheet 70)


N
R. 9 W.
(Joins sheet 67)
T. 79 N.
(Joins sheet 64)
(Joins sheet 70)
(Joins sheet 71)
18
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21

(Joins sheet 2)

(Joins sheet 8)

(Joins sheet 9)


N
(Joins sheet 68)
R. 9 W.
(Joins sheet 69)
T. 79 N.
JOHNSON COUNTY
(Joins sheet 72)
13
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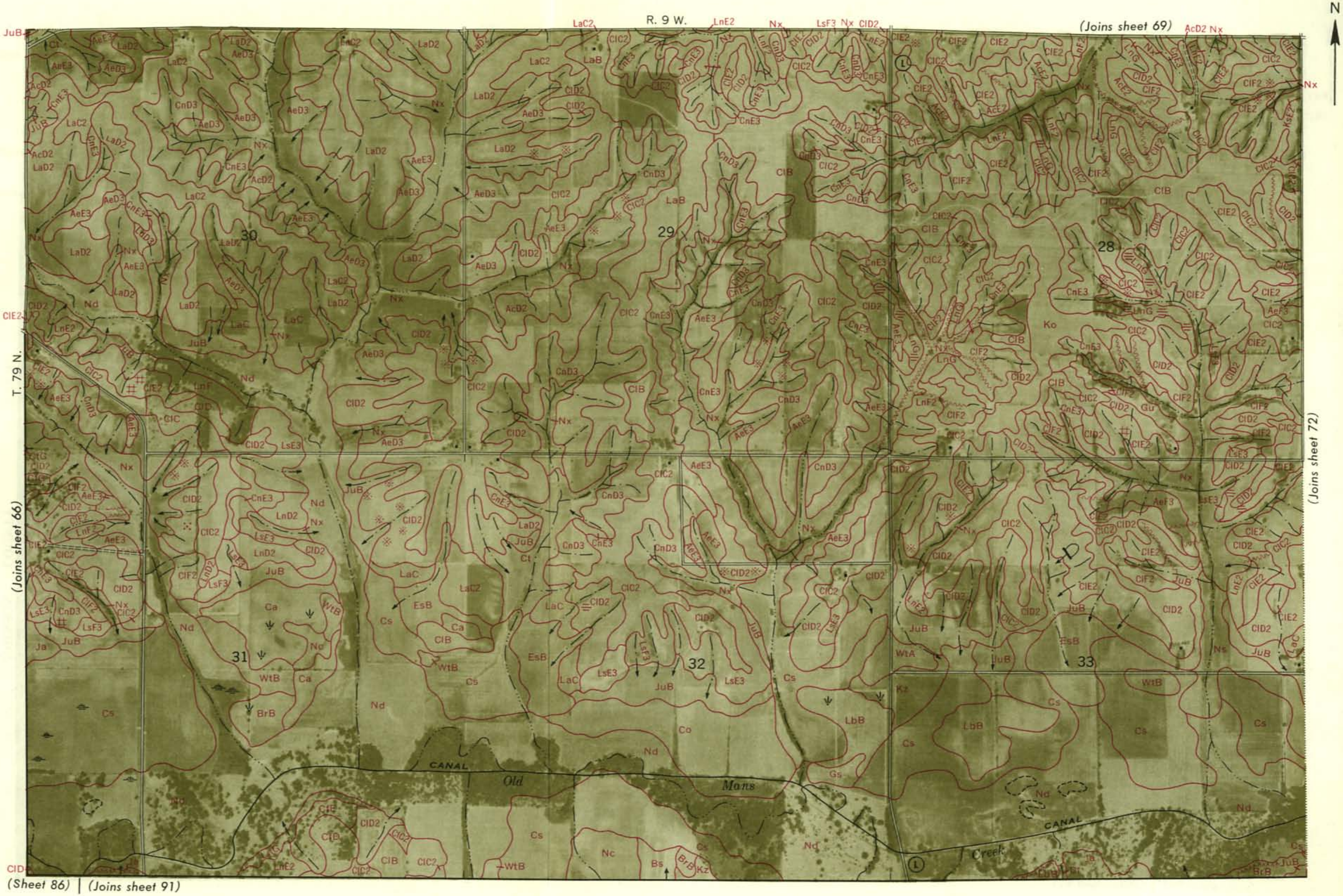
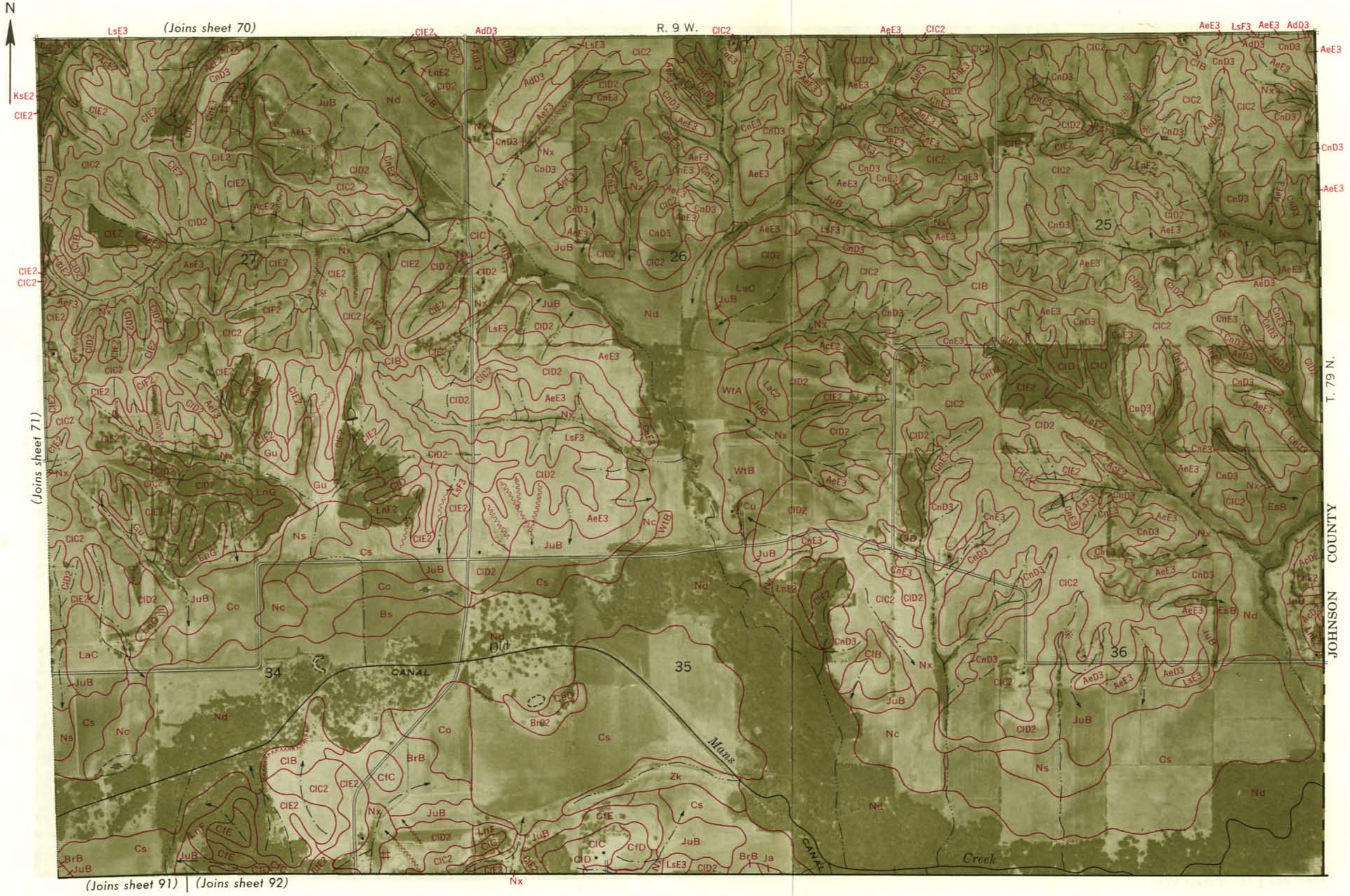
22
23
24


N
R. 9 W.
(Joins sheet 69)
T. 79 N.
(Joins sheet 66)
(Joins sheet 72)
(Sheet 86)
(Joins sheet 91)
30
29
28
31
32
33
CANAL
Old
Mans
Creek

(72)


N
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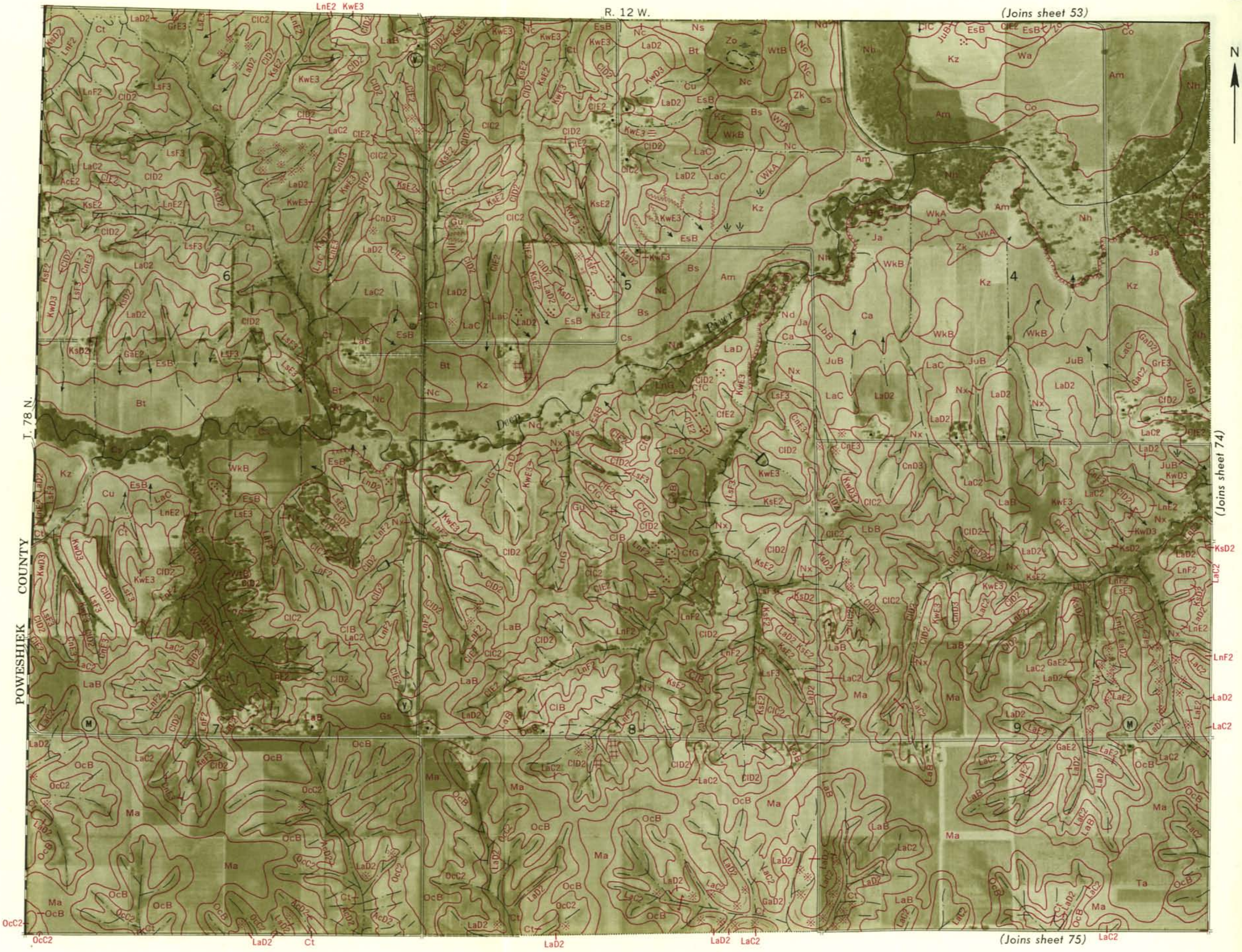
R. 9 W.
T. 79 N.
(Joins sheet 71)
JOHNSON COUNTY
(Joins sheet 91)
(Joins sheet 92)
27
26
25
34
35
36
Old
CANAL
Mans
Creek


R. 12 W.
(Joins sheet 53)
N
T. 78 N.
POWESHIEK COUNTY
(Joins sheet 74)
(Joins sheet 75)
Deep River
4
5
6
7
8
9


N
(Joins sheet 54)
R. 12 W.
T. 78 N.
(Joins sheet 73)
(Joins sheet 79)
(Joins sheet 76)
1
2
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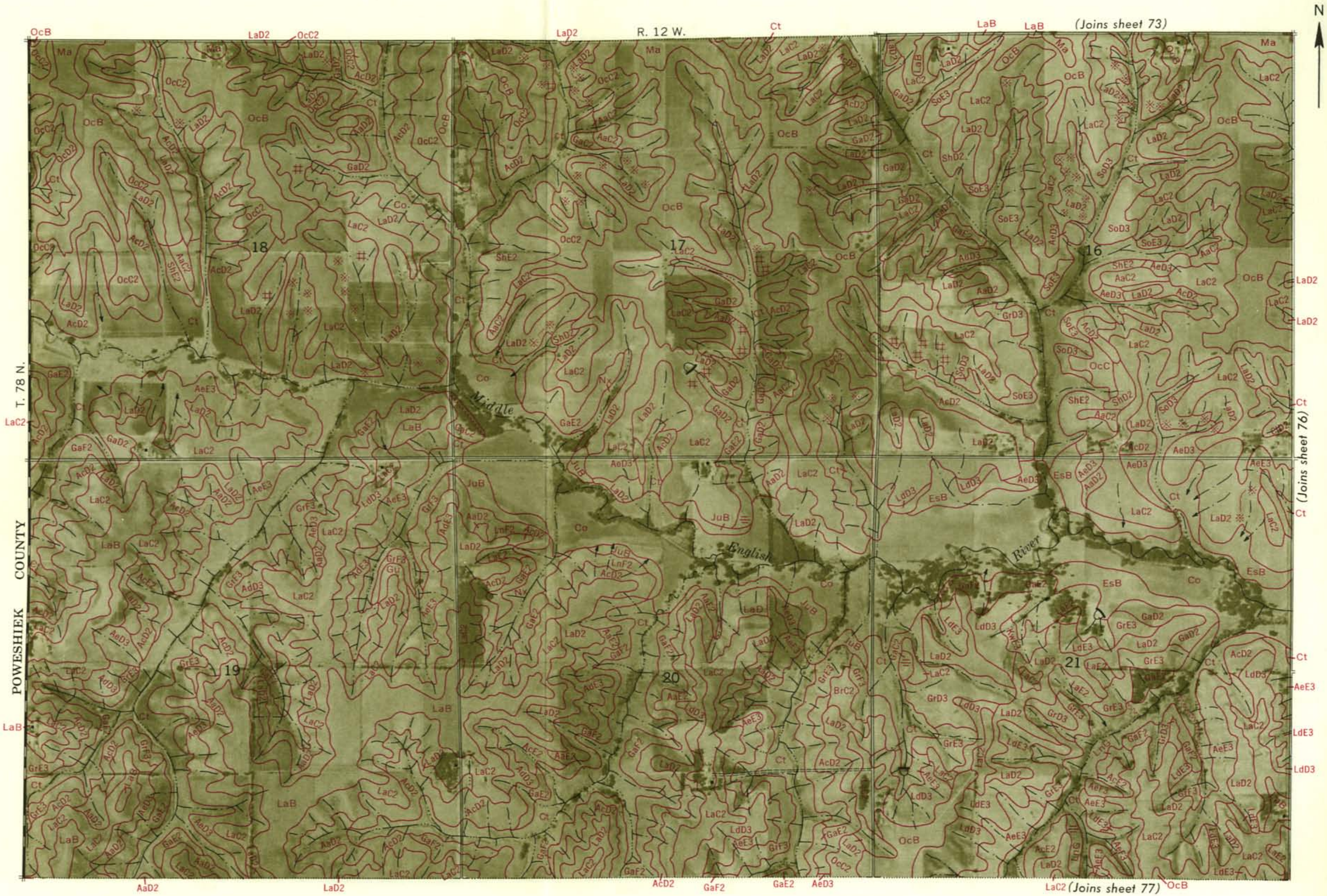
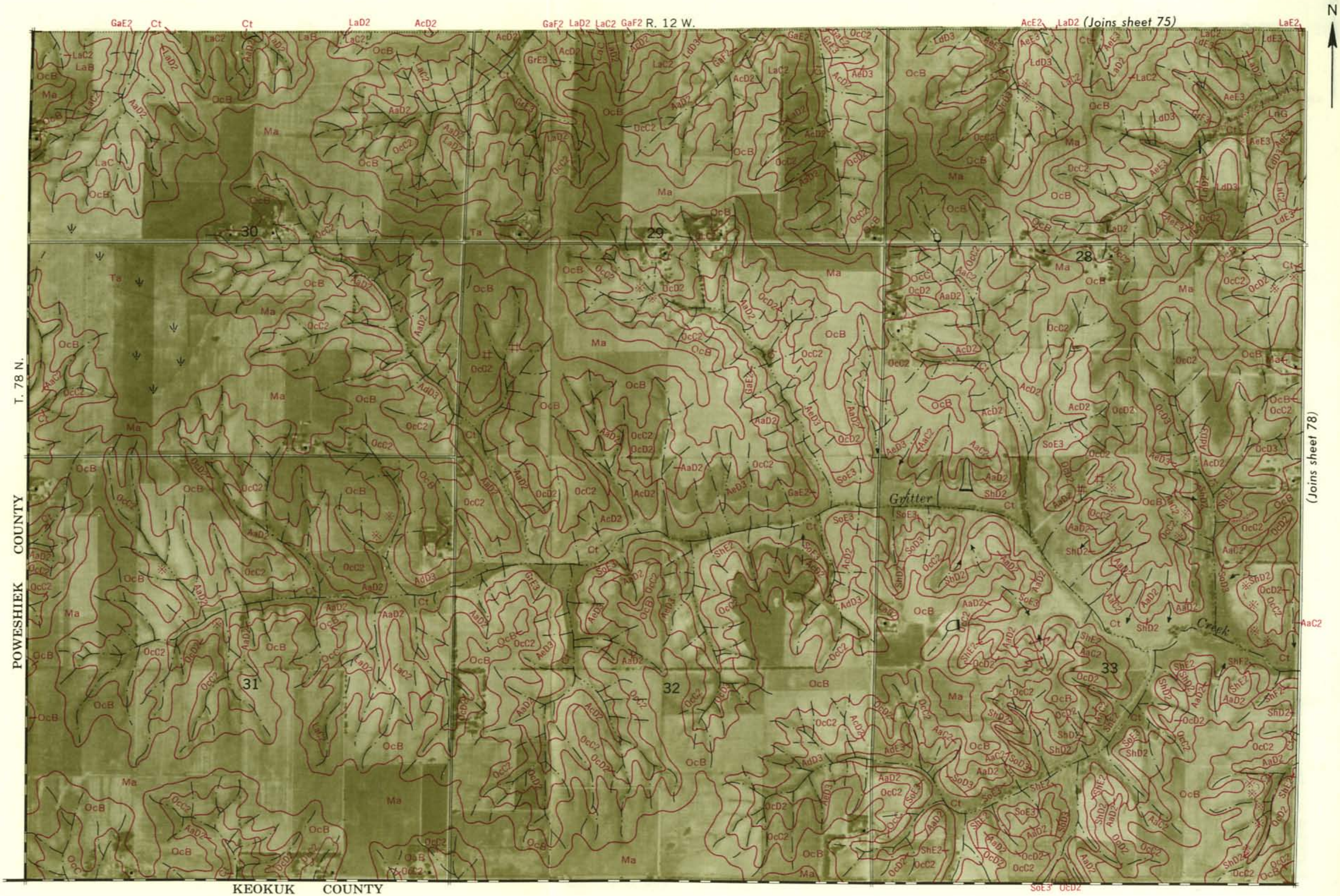
10
11
12


N
R. 12 W.
(Joins sheet 73)
(Joins sheet 76)
(Joins sheet 77)
T. 78 N.
POWESHIEK COUNTY
18
17
16
19
20
21
Middle
English
River


N
(Joins sheet 74)
R. 12 W.
T. 78 N.
(Joins sheet 75)
(Joins sheet 81)
(Joins sheet 78)
15
14
13
22
23
24
Middle
English
River


N
R. 12 W.
(Joins sheet 75)
T. 78 N.
POWESHIEK COUNTY
KEOKUK COUNTY
(Joins sheet 78)
Gritter
Creek
30
29
28
31
32
33


N
(Joins sheet 76)
R. 12 W.
T. 78 N.
(Joins sheet 77)
(Joins sheet 83)
KEOKUK COUNTY
27
26
25
34
35
36
Gritter
Creek


R. 11 W.
(Joins sheet 59)
N
DEEP RIVER
T. 78 N.
(Joins sheet 74)
(Joins sheet 80)
Millersburg
(Joins sheet 81)

8


N
R. 11 W.
BENTON COUNTY
T. 81 N.
(Joins sheet 7)
(Joins sheet 13)
(Joins sheet 10)
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11
12

80


(Joins sheet 60)
R. 11 W.
N
(Joins sheet 79)
T. 78 N.
(Joins sheet 85)
(Joins sheet 82)
NORTH
ENGLISH
RIVER
1
2
3
7
10
11
12


N
R. 11 W
T. 78 N.
(Joins sheet 79)
(Joins sheet 76)
(Joins sheet 82)
(Joins sheet 83)
16
17
18
19
20
21
English
River
Middle

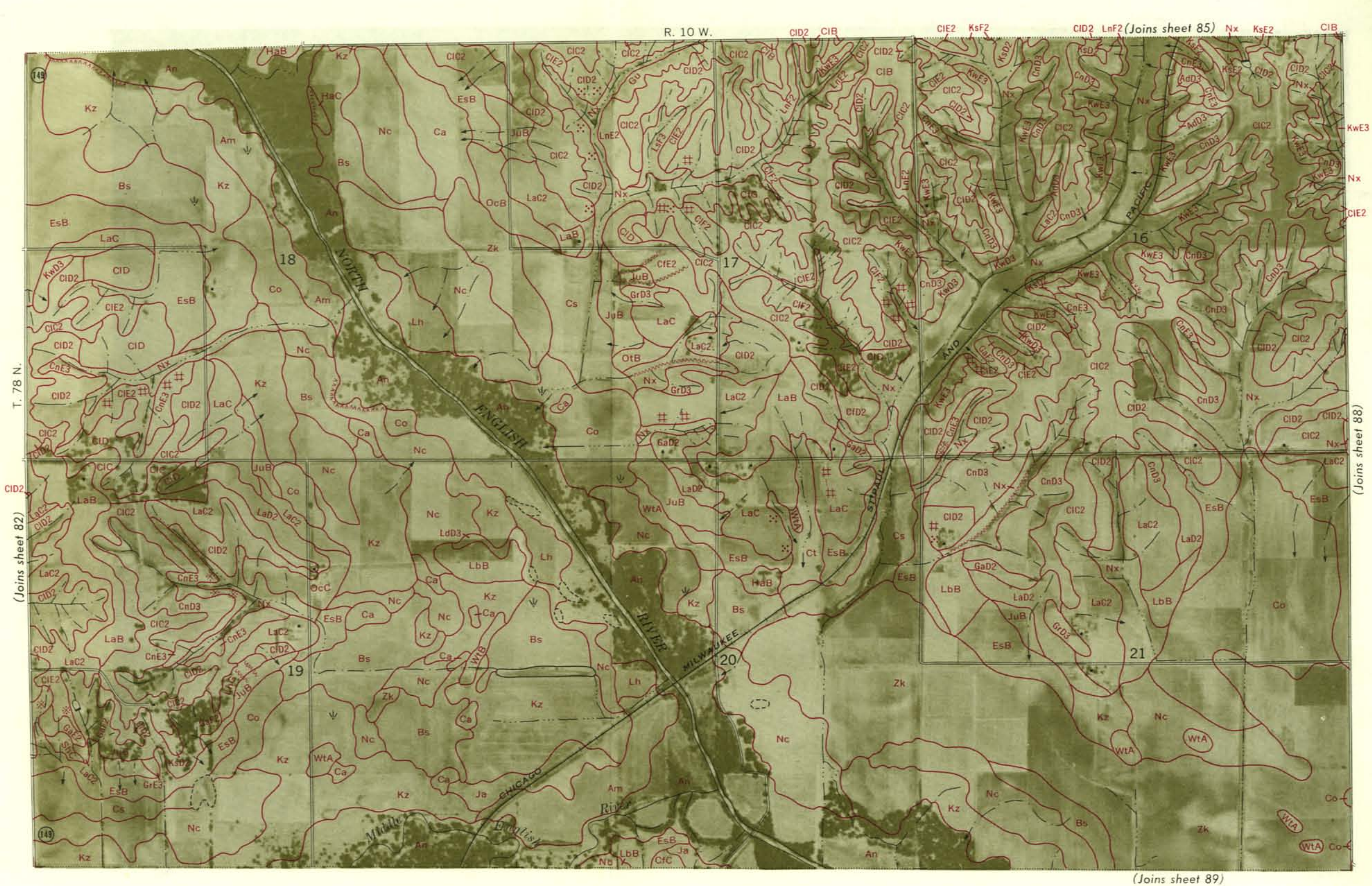

N
(Joins sheet 80)
R. 11 W.
T. 78 N.
(Joins sheet 81)
(Joins sheet 87)
(Joins sheet 84)
15
14
13
22
23
24
Middle
English
River


N
R. 11 W.
(Joins sheet 81)
(Joins sheet 84)
(Joins sheet 78)
T. 78 N.
KEOKUK COUNTY
30
29
28
31
32
33


N
(Joins sheet 82)
R. 11 W.
(Joins sheet 83)
(Joins sheet 89)
T. 78 N.
Middle English River
Gritter Creek
North English
27
26
25
34
35
36
KEOKUK COUNTY


R. 10 W.
(Joins sheet 65) | (sh 66)
N
T. 78 N.
(Joins sheet 80)
(Joins sheet 86)
(Joins sheet 87)
Parnell
NORTH ENGLISH RIVER
CHICAGO MILWAUKEE ST PAUL PACIFIC
4
5
6
7
8
9


N
R. 10 W.
(Joins sheet 66) | (Sheet 71)
T. 78 N.
(Joins sheet 85)
(Joins sheet 91)
(Joins sheet 88)
Parnell
CHICAGO MILWAUKEE ST PAUL AND PACIFIC
3
2
1
10
11
12


N
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T. 78 N.
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(Joins sheet 82)
(Joins sheet 88)
(Joins sheet 89)
NORTH ENGLISH RIVER
Middle English River
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
149
16
17
18
19
20
21


N
(Joins sheet 86)
R. 10 W.
(Joins sheet 87)
T. 78 N.
(Joins sheet 93)
(Joins sheet 90)
15
14
13
22
23
24


R. 10 W.
(Joins sheet 87)
N
T. 78 N.
(Joins sheet 84)
(Joins sheet 90)
Middle English River
NORTH ENGLISH RIVER
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC
30
29
28
31
32
33
KEOKUK COUNTY

N

R. 11 W.

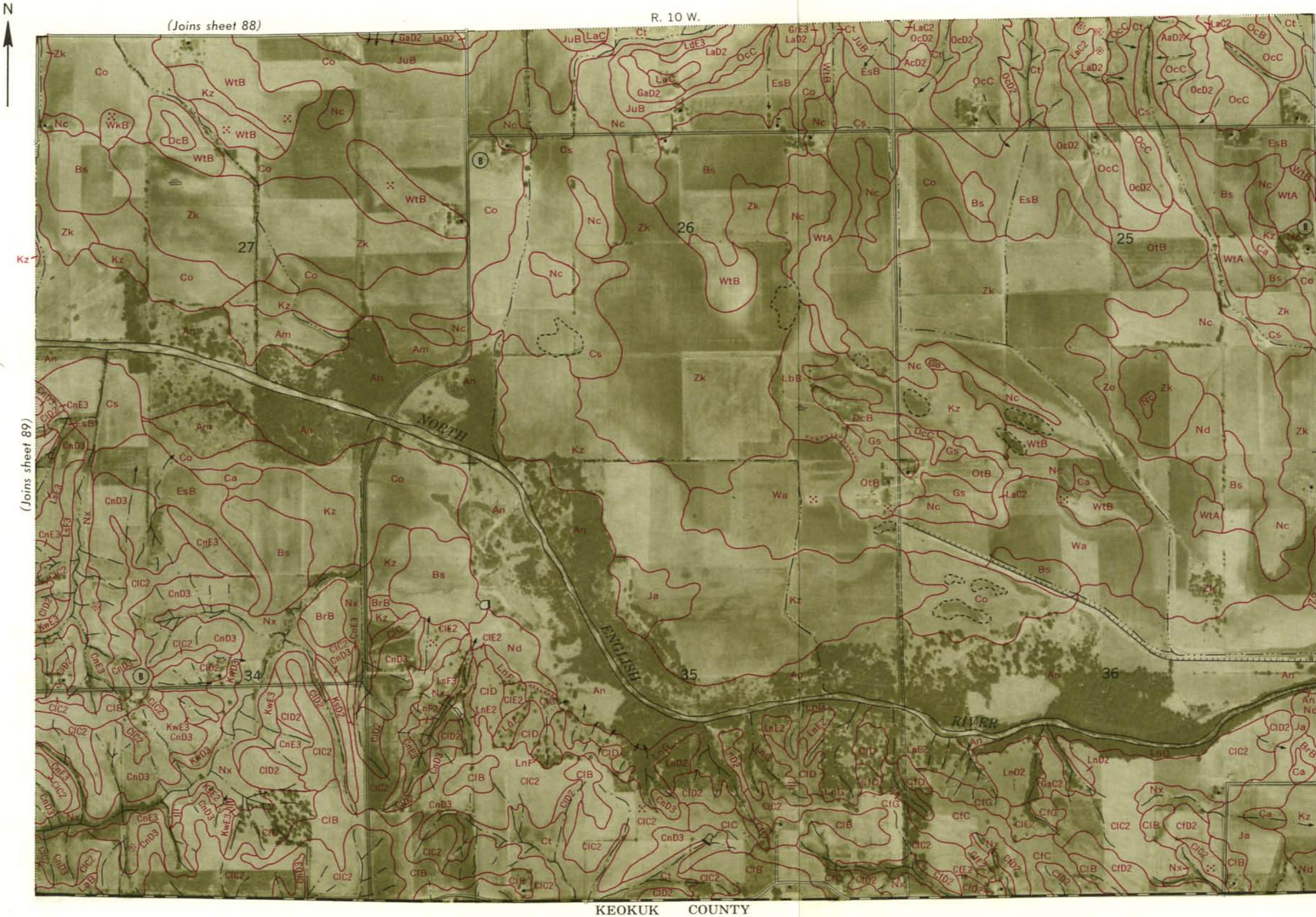
(Joins sheet 7)

T. 81 N.

(Joins sheet 4)

(Joins sheet 10)

(Joins sheet 11)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(Joins sheet 89)
(Joins sheet 95)
T. 78 N.
27
26
25
34
35
36
NORTH
ENGLISH
RIVER
KEOKUK COUNTY


R. 9 W.
(Joins sheet 71)
(Joins sheet 72)
N
T. 78 N.
(Joins sheet 86)
(Joins sheet 92)
(Joins sheet 93)
Holbrook
Deer
Creek
4
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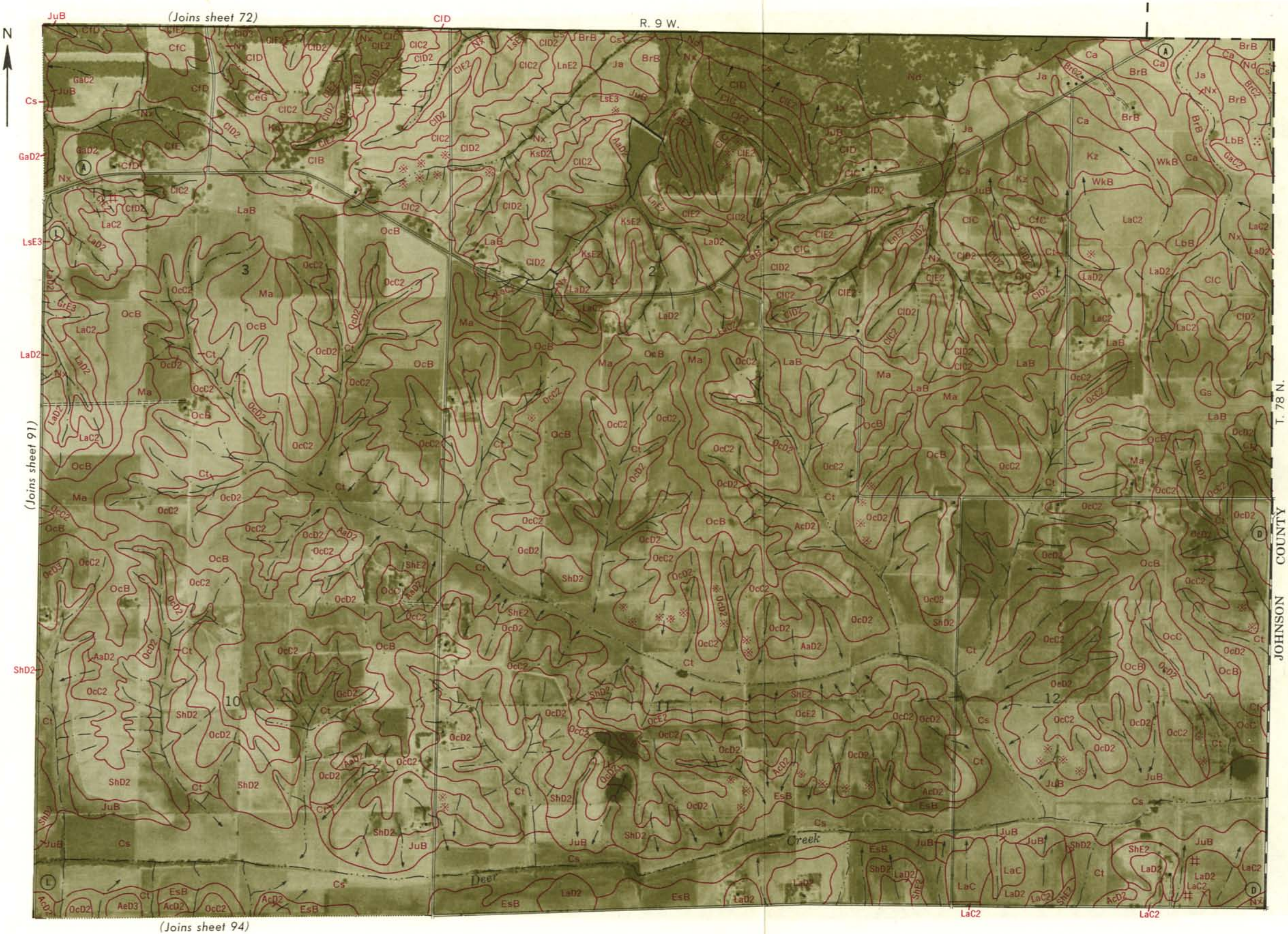
6
7
8
9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R. 9 W.
N
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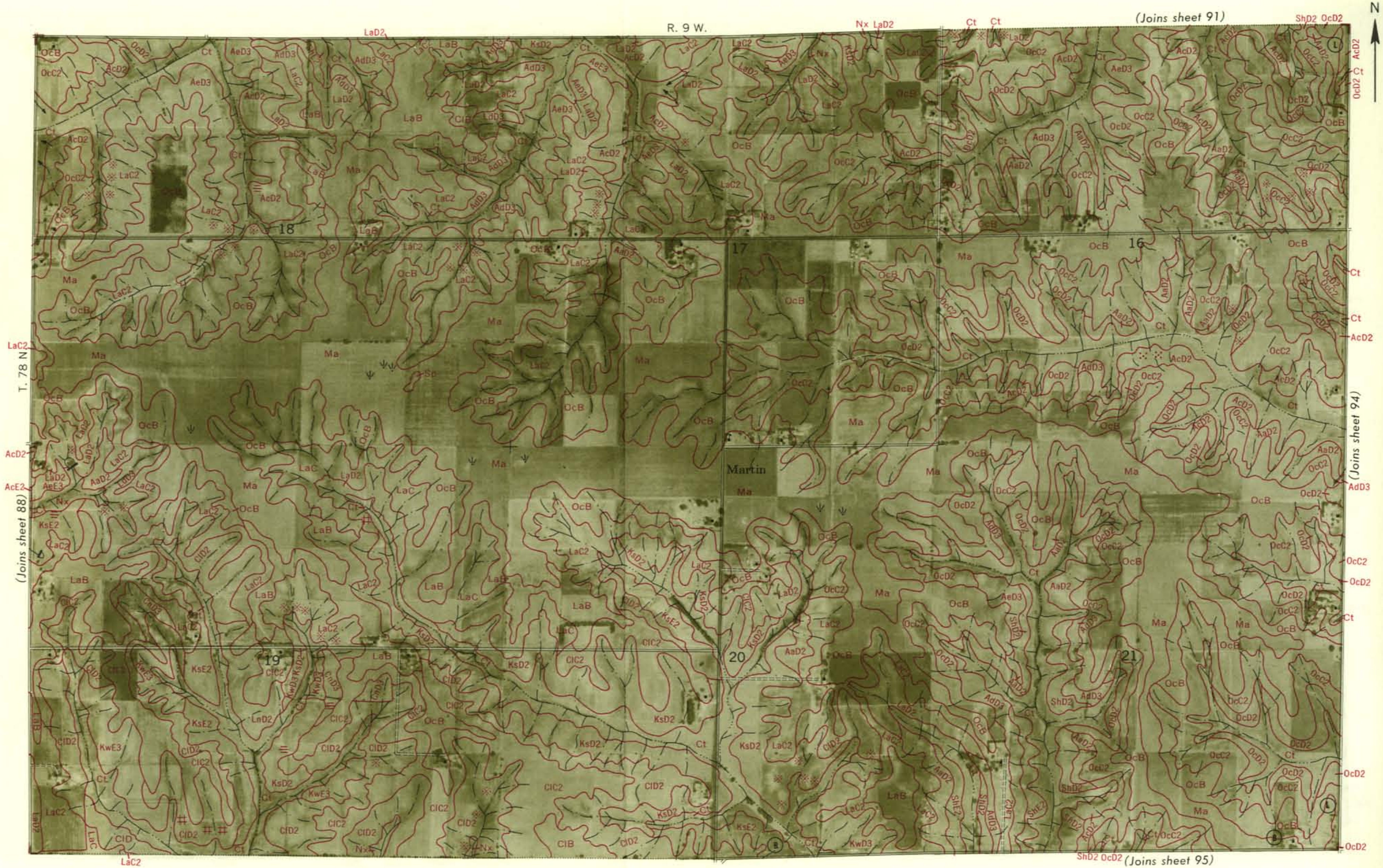
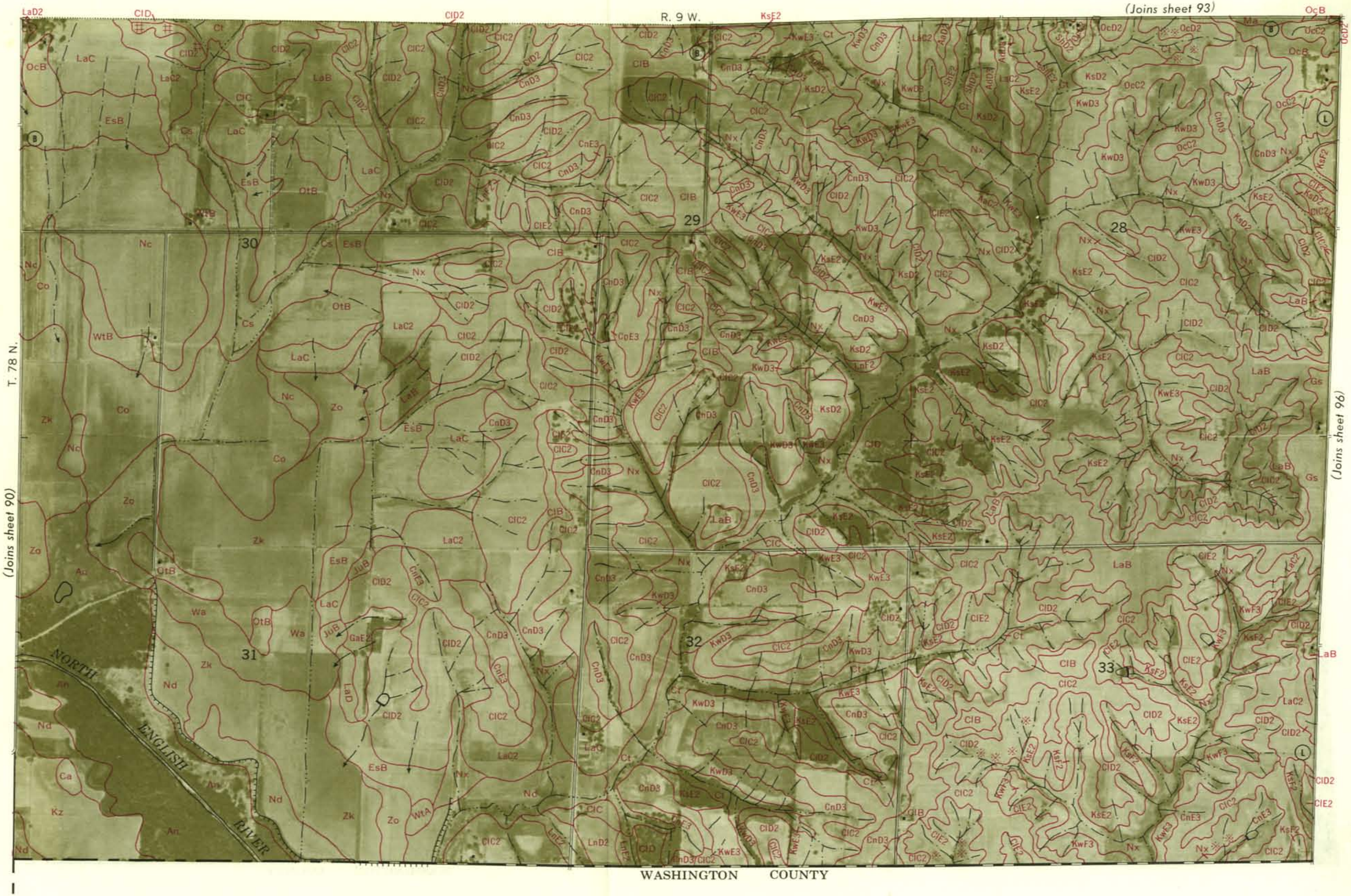
T. 78 N.
JOHNSON COUNTY
Deer Creek
(Joins sheet 94)


N
R. 9 W.
T. 78 N.
(Joins sheet 91)
(Joins sheet 94)
(Joins sheet 95)
(Joins sheet 88)
Martin
16
17
18
19
20
21


N
(Joins sheet 92)
R. 9 W.
(Joins sheet 93)
T. 78 N.
JOHNSON COUNTY
(Joins sheet 96)
15
14
13
22
23
24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R. 9 W.
T. 78 N.
(Joins sheet 90)
(Joins sheet 96)
29
28
30
31
32
33
NORTH
ENGLISH
RIVER
WASHINGTON COUNTY


N
(Joins sheet 94)
R. 9 W.
(Joins sheet 95)
T. 78 N.
JOHNSON COUNTY
WASHINGTON COUNTY
27
26
25
34
35
36

GUIDE TO MAPPING UNITS

[See table 1, page 10, for approximate acreage and proportionate extent of the soils; table 2, page 58, for estimated yields of principal crops. For information about management of woodland, refer to pages 76 through 82, and see table 3, page 78. For facts about the engineering properties of the soils, turn to the section beginning on page 82.

[For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs]

Map symbol	Mapping unit	Described on page	Capability unit: Symbol	Capability unit: Page
AaC2	Adair clay loam, 5 to 9 percent slopes, moderately eroded	9	IIIe-5	53
AaD2	Adair clay loam, 9 to 14 percent slopes, moderately eroded	9	IVe-3	54
AaE2	Adair clay loam, 14 to 18 percent slopes, moderately eroded	12	VIe-3	56
AcD2	Adair clay loam, thin solum, 9 to 14 percent slopes, moderately eroded	12	IVe-3	54
AcE2	Adair clay loam, thin solum, 14 to 18 percent slopes, moderately eroded	12	VIe-3	56
AdD3	Adair soils, 9 to 14 percent slopes, severely eroded	12	VIe-3	56
AdE3	Adair soils, 14 to 18 percent slopes, severely eroded	12	VIIe-1	56
AeD3	Adair soils, thin solum, 9 to 14 percent slopes, severely eroded	12	VIe-3	56
AeE3	Adair soils, thin solum, 14 to 18 percent slopes, severely eroded	12	VIIe-1	56
AeF3	Adair soils, thin solum, 18 to 25 percent slopes, severely eroded	12	VIIe-1	56
Al	Alluvial land	13	Vw-1	55
Am	Amana silt loam	13	I-2	50
An	Amana-Lawson-Nodaway complex	13	Vw-1	55
As	Atterberry silt loam	13	I-1	49
At	Atterberry silt loam, benches	13	I-1	49
BaC2	Bassett loam, 5 to 9 percent slopes, moderately eroded	14	IIIe-1	52
BaD2	Bassett loam, 9 to 14 percent slopes, moderately eroded	14	IIIe-3	52
BaE2	Bassett loam, 14 to 18 percent slopes, moderately eroded	14	IVe-1	54
BaF2	Bassett loam, 18 to 25 percent slopes, moderately eroded	14	VIe-2	56
BeD3	Bassett soils, 9 to 14 percent slopes, severely eroded	14	IVe-4	55
BeE3	Bassett soils, 14 to 18 percent slopes, severely eroded	14	VIe-1	55
BrA	Bertrand silt loam, 0 to 2 percent slopes	15	I-1	49
BrB	Bertrand silt loam, 2 to 5 percent slopes	15	IIe-2	50
BrC2	Bertrand silt loam, 5 to 9 percent slopes, moderately eroded	15	IIIe-2	52
Bs	Bremer silty clay loam	15	IIw-2	51
Bt	Bremer silt loam, overwash	15	IIw-2	51
Ca	Chariton silt loam	15	IIIw-2	53
CeB	Chelsea fine sand, 2 to 9 percent slopes	16	IVs-1	55
CeD	Chelsea fine sand, 9 to 18 percent slopes	16	VIIs-1	57
CeG	Chelsea fine sand, 18 to 40 percent slopes	16	VIIs-1	57
CfC	Chelsea-Fayette-Lamont complex, 5 to 9 percent slopes	16	IIIs-1	53
CfD	Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes	16	IVe-5	55
CfD2	Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes, moderately eroded	16	IVe-5	55
CfE	Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes	16	VIe-2	56
CfE2	Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes, moderately eroded	17	VIe-2	56
CfG	Chelsea-Fayette-Lamont complex, 18 to 40 percent slopes	17	VIIe-3	57
ClB	Clinton silt loam, 2 to 5 percent slopes	17	IIe-2	50
ClC	Clinton silt loam, 5 to 9 percent slopes	17	IIIe-2	52
ClC2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded	17	IIIe-2	52
ClD	Clinton silt loam, 9 to 14 percent slopes	17	IIIe-4	52
ClD2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded	17	IIIe-4	52
ClE2	Clinton silt loam, 14 to 18 percent slopes, moderately eroded	17	IVe-2	54
ClF2	Clinton silt loam, 18 to 25 percent slopes, moderately eroded	18	VIe-2	56
CnD3	Clinton soils, 9 to 14 percent slopes, severely eroded	18	IVe-4	55
CnE3	Clinton soils, 14 to 18 percent slopes, severely eroded	18	VIe-1	55
Co	Colo silty clay loam	18	IIw-2	51
Cs	Colo silt loam, overwash	18	IIw-2	51
Ct	Colo-Ely complex, 1 to 5 percent slopes	18	IIw-1	50
Cu	Coppock silt loam	19	IIw-1	50
DcA	Dickinson sandy loam, 0 to 2 percent slopes	19	IIIs-3	54
DcB	Dickinson sandy loam, 2 to 5 percent slopes	19	IIIs-3	54
DcC	Dickinson sandy loam, 5 to 9 percent slopes	20	IIIs-1	53
DdB	Dinsdale silty clay loam, 2 to 5 percent slopes	20	IIe-1	50
DdC	Dinsdale silty clay loam, 5 to 9 percent slopes	20	IIIe-1	52
DoB	Downs silt loam, 2 to 5 percent slopes	20	IIe-1	50
DoC	Downs silt loam, 5 to 9 percent slopes	20	IIIe-1	52
DoC2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	20	IIIe-1	52
DoD2	Downs silt loam, 9 to 14 percent slopes, moderately eroded	20	IIIe-3	52
DoE2	Downs silt loam, 14 to 18 percent slopes, moderately eroded	21	IVe-1	54
DpB	Downs silt loam, benches, 2 to 5 percent slopes	21	IIe-1	50
DsD3	Downs soils, 9 to 14 percent slopes, severely eroded	21	IVe-4	55
DsE3	Downs soils, 14 to 18 percent slopes, severely eroded	21	VIe-1	55
EsB	Ely silt loam, 2 to 5 percent slopes	22	IIw-1	50
FaB	Fayette silt loam, 2 to 5 percent slopes	22	IIe-2	50
FaC	Fayette silt loam, 5 to 9 percent slopes	22	IIIe-2	52
FaC2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	22	IIIe-2	52
FaD	Fayette silt loam, 9 to 14 percent slopes	22	IIIe-4	52
FaD2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded	22	IIIe-4	52
FaE	Fayette silt loam, 14 to 18 percent slopes	23	IVe-2	54
FaE2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded	23	IVe-2	54
FaF	Fayette silt loam, 18 to 25 percent slopes	23	VIe-2	56
FaF2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded	23	VIe-2	56
FaG	Fayette silt loam, 25 to 40 percent slopes	23	VIIe-3	57
FbB	Fayette silt loam, benches, 2 to 5 percent slopes	23	IIe-2	50
FsD3	Fayette soils, 9 to 14 percent slopes, severely eroded	23	IVe-4	55
FsE3	Fayette soils, 14 to 18 percent slopes, severely eroded	24	VIe-1	55
FsF3	Fayette soils, 18 to 25 percent slopes, severely eroded	24	VIe-2	56
GaC2	Gara loam, 5 to 9 percent slopes, moderately eroded	24	IIIe-1	52
GaD2	Gara loam, 9 to 14 percent slopes, moderately eroded	24	IIIe-3	52
GaE2	Gara loam, 14 to 18 percent slopes, moderately eroded	24	IVe-1	54
GaF2	Gara loam, 18 to 25 percent slopes, moderately eroded	24	VIe-2	56
GrD3	Gara soils, 9 to 14 percent slopes, severely eroded	25	IVe-4	55
GrE3	Gara soils, 14 to 18 percent slopes, severely eroded	25	VIe-1	55
GrF3	Gara soils, 18 to 25 percent slopes, severely eroded	25	VIIe-1	56
Gs	Givin silt loam	25	I-1	49
Gu	Gullied land	25	VIIe-2	57
HaA	Hagener fine sand, 0 to 2 percent slopes	26	IVs-1	55
HaB	Hagener fine sand, 2 to 5 percent slopes	26	IVs-1	55
HaC	Hagener fine sand, 5 to 9 percent slopes	26	IVs-1	55
HaD	Hagener fine sand, 9 to 14 percent slopes	26	VIs-1	56
HaE	Hagener fine sand, 14 to 25 percent slopes	26	VIIs-1	57
HgB	Hagener-Tama complex, 2 to 5 percent slopes	26	IIIs-3	54
HgC	Hagener-Tama complex, 5 to 9 percent slopes	27	IIIs-1	53
HgC2	Hagener-Tama complex, 5 to 9 percent slopes, moderately eroded	27	IIIs-1	53
HgD2	Hagener-Tama complex, 9 to 14 percent slopes, moderately eroded	27	IVe-5	55
HgE2	Hagener-Tama complex, 14 to 18 percent slopes, moderately eroded	27	VIe-2	56
HoD2	Hopper silt loam, 9 to 14 percent slopes, moderately eroded	27	IIIe-4	52
HoE2	Hopper silt loam, 14 to 18 percent slopes, moderately eroded	27	IVe-2	54
HoE3	Hopper silt loam, 14 to 18 percent slopes, severely eroded	28	VIe-1	55
HoF2	Hopper silt loam, 18 to 25 percent slopes, moderately eroded	28	VIe-2	56
Ja	Jackson silt loam	28	IIw-4	51
JuB	Judson silt loam, 2 to 6 percent slopes	28	IIe-1	50
KnB	Kenyon loam, 2 to 5 percent slopes	29	IIe-1	50
KnC	Kenyon loam, 5 to 9 percent slopes	29	IIIe-1	52
KnC2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	29	IIIe-1	52
KnD2	Kenyon loam, 9 to 14 percent slopes, moderately eroded	29	IIIe-3	52
Ko	Keomah silt loam	29	IIw-4	51
KsD2	Keswick loam, 9 to 14 percent slopes, moderately eroded	30	IVe-3	54

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page
KsE2	Keswick loam, 14 to 18 percent slopes, moderately eroded	30	VIe-3	56
KsF2	Keswick loam, 18 to 25 percent slopes, moderately eroded	30	VIIe-1	56
KwD3	Keswick soils, 9 to 14 percent slopes, severely eroded	30	VIe-3	56
KwE3	Keswick soils, 14 to 18 percent slopes, severely eroded	30	VIIe-1	56
KwF3	Keswick soils, 18 to 25 percent slopes, severely eroded	31	VIIe-1	56
Kz	Koszta silt loam	31	I-1	49
LaB	Ladoga silt loam, 2 to 5 percent slopes	31	IIe-1	50
LaC	Ladoga silt loam, 5 to 9 percent slopes	31	IIIe-1	52
LaC2	Ladoga silt loam, 5 to 9 percent slopes, moderately eroded	31	IIIe-1	52
LaD	Ladoga silt loam, 9 to 14 percent slopes	32	IIIe-3	52
LaD2	Ladoga silt loam, 9 to 14 percent slopes, moderately eroded	32	IIIe-3	52
LaE2	Ladoga silt loam, 14 to 18 percent slopes, moderately eroded	32	IVe-1	54
LbB	Ladoga silt loam, benches, 2 to 5 percent slopes	32	IIe-1	50
LdD3	Ladoga soils, 9 to 14 percent slopes, severely eroded	32	IVe-4	55
LdE3	Ladoga soils, 14 to 18 percent slopes, severely eroded	32	VIe-1	55
Le	Lawler loam	33	I-1	49
Lh	Lawson silt loam	33	I-2	50
LnD2	Lindley loam, 9 to 14 percent slopes, moderately eroded	34	IVe-3	54
LnE2	Lindley loam, 14 to 18 percent slopes, moderately eroded	34	VIe-3	56
LnF	Lindley loam, 18 to 25 percent slopes	34	VIIe-1	56
LnF2	Lindley loam, 18 to 25 percent slopes, moderately eroded	34	VIIe-1	56
LnG	Lindley loam, 25 to 40 percent slopes	34	VIIe-3	57
LsD3	Lindley soils, 9 to 14 percent slopes, severely eroded	34	VIe-3	56
LsE3	Lindley soils, 14 to 18 percent slopes, severely eroded	35	VIIe-1	56
LsF3	Lindley soils, 18 to 25 percent slopes, severely eroded	35	VIIe-1	56
Ma	Mahaska silty clay loam	35	I-1	49
Mu	Muscatine silty clay loam	35	I-1	49
Nc	Nevin silty clay loam	36	I-1	49
Nd	Nodaway silt loam	36	I-2	50
Nh	Nodaway silt loam, channeled	36	Vw-1	55
Ns	Nodaway silt loam, silty clay loam substratum	36	IIw-2	51
Nx	Nodaway-Ely complex	36	IIw-1	50
OcB	Otley silty clay loam, 2 to 5 percent slopes	37	IIe-1	50
OcC	Otley silty clay loam, 5 to 9 percent slopes	37	IIIe-1	52
OcC2	Otley silty clay loam, 5 to 9 percent slopes, moderately eroded	38	IIIe-1	52
OcD2	Otley silty clay loam, 9 to 14 percent slopes, moderately eroded	38	IIIe-3	52
OcD3	Otley silty clay loam, 9 to 14 percent slopes, severely eroded	38	IVe-4	55
OcE2	Otley silty clay loam, 14 to 18 percent slopes, moderately eroded	38	IVe-1	54
OtB	Otley silty clay loam, benches, 2 to 5 percent slopes	38	IIe-1	50
ShC	Shelby loam, 5 to 9 percent slopes	38	IIIe-1	52
ShC2	Shelby loam, 5 to 9 percent slopes, moderately eroded	39	IIIe-1	52
ShD2	Shelby loam, 9 to 14 percent slopes, moderately eroded	39	IIIe-3	52
ShE2	Shelby loam, 14 to 18 percent slopes, moderately eroded	39	IVe-1	54
ShF2	Shelby loam, 18 to 25 percent slopes, moderately eroded	39	VIe-2	56
SoD3	Shelby soils, 9 to 14 percent slopes, severely eroded	39	IVe-4	55
SoE3	Shelby soils, 14 to 18 percent slopes, severely eroded	39	VIe-1	55
Sp	Sperry silt loam	40	IIIw-2	53
Sr	Stronghurst silt loam	40	IIw-4	51
St	Stronghurst silt loam, benches	40	IIw-4	51
Ta	Taintor silty clay loam	40	IIw-3	51
TcB	Tama silty clay loam, 2 to 5 percent slopes	41	IIe-1	50
TcC	Tama silty clay loam, 5 to 9 percent slopes	41	IIIe-1	52
TcC2	Tama silty clay loam, 5 to 9 percent slopes, moderately eroded	41	IIIe-1	52
TcD2	Tama silty clay loam, 9 to 14 percent slopes, moderately eroded	41	IIIe-3	52
TcD3	Tama silty clay loam, 9 to 14 percent slopes, severely eroded	41	IVe-4	55
TcE2	Tama silty clay loam, 14 to 18 percent slopes, moderately eroded	41	IVe-1	54
ThA	Tama silty clay loam, benches, 0 to 2 percent slopes	41	I-1	49
ThB	Tama silty clay loam, benches, 2 to 5 percent slopes	42	IIe-1	50
TmB	Tell silt loam, 2 to 5 percent slopes	42	IIs-1	51
TmC	Tell silt loam, 5 to 9 percent slopes	42	IIIs-2	53
TmC2	Tell silt loam, 5 to 9 percent slopes, moderately eroded	42	IIIs-2	53
TmD2	Tell silt loam, 9 to 14 percent slopes, moderately eroded	42	IVe-5	55
Ud	Udolpho loam	43	I-1	49
Wa	Wabash silty clay	43	IIIw-1	53
Wb	Walford silt loam, benches	44	IIIw-2	53
WkA	Watkins silt loam, 0 to 2 percent slopes	44	I-1	49
WkB	Watkins silt loam, 2 to 5 percent slopes	44	IIe-1	50
WmB	Waubeek silt loam, 2 to 5 percent slopes	44	IIe-1	50
WmC2	Waubeek silt loam, 5 to 9 percent slopes, moderately eroded	44	IIIe-1	52
WnA	Waukegan loam, 0 to 2 percent slopes	45	I-1	49
WnB	Waukegan loam, 2 to 5 percent slopes	45	IIe-1	50
WnC	Waukegan loam, 5 to 9 percent slopes	45	IIIs-2	53
WsB	Waukegan silt loam, 2 to 5 percent slopes	45	IIs-1	51
WsC	Waukegan silt loam, 5 to 9 percent slopes	45	IIIs-2	53
WtA	Wiota silt loam, 0 to 2 percent slopes	46	I-1	49
WtB	Wiota silt loam, 2 to 5 percent slopes	46	IIe-1	50
Zk	Zook silty clay loam	46	IIw-2	51
Zo	Zook silt loam, overwash	46	IIw-2	51